EDITORIAL

THE article in this issue concerning the insurance and servicing of TV receivers should be closely studied.

Quite a few things in it don't make nice reading.

It is not our prime intention to voice attacks directly on any of the parties involved, but anyone can see with half an eye that the position is wide open to processes of dissatisfaction, dishonesty and fraud.

That is a very fragile basis upon which to build a maintenance service for the thousands of TV sets now in operation and for those which will be installed elsewhere.

The article tells of cases where an attempt is being made to honour the spirit of a contract, even when the wording doesn't make the spirit very clear.

But there are probably far more in which the vendors individually or collectively are prepared to allow the customer to make a purchase, knowing full well that the full import of his servicing guarantees and contracts are not understood.

It is becoming harder and harder for many a radio dealer to make money from TV sales, largely because of the discounts and perks which are freely offered by some competitors.

If he fails to match such offers, he won't get business, and to create sales resistance by waking up such a ticklish subject as service and insurance when he doesn't have to is too much to expect.

Unfortunately it all seems part of the picture in which sections of the radio trade set out to make quick money during a huge burst of sales unequalled anywhere else in the world.

Nearly everyone went on the bandwagon. One still remembers firms specialising in sales and service which rode to a fall, losing large sums of money. The conferences among dealers, including those inspired because some of our largest and most reputable firms could not withstand the pressure to cut prices and discounts. The newspaper advertisements, more reminiscent of cut-throat selling in Chicago than of a potentially prosperous Australian industry.

Even the local Councils, with their 10/ inspection fee for aerial erection, were in it, a process recently reported in the words of a suburban councillor as being merely an easy method of collecting more revenue.

The principle of laissez faire, I suppose, implies the right of an industry to cut its own throat if it so desires, and to wring from the public as much as the law allows.

That's fair enough, but it's only fair if, at the same time, the public is aware of what is going on, so that it can exercise its own judgment in the matter.

John Moyle

INDEX

	Page		Page
First Test On Space Capsule	2	Facts About Photoflash Bulbs	42
Melbourne Scientist Plots Cosmic Rays	4	Here's Your Answer, Tom!	53
New Valves Are Thimble Size	11	Four-Transistor Superhet	56
More On Electro-Luminescence	13	A Reader Built It	65
Glass Surrounds Us	14	Let's Buy An Argument	70
Technical Review	19	Trade Reviews And Releases	81
News and Views of the Month	25	Which Loudspeaker For Stereo	84
17 Watt Stereo Amplifier	29	Off The Record—News and Reviews	89
From The Serviceman Who Tells	37	Short-wave Notes	98
		The Amateur Bands	99
		Answers To Correspondents	109

RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION HOBBIES AND POPULAR SCIENCE

EDITOR
JOHN MOYLE
S.M.I.R.E. (Aust.)

TECHNICAL STAFF
NEVILLE WILLIAMS
M.I.R.E. (Aust.)

TECHNICAL STAFF
MAURICE FINDLAY
A.S.T.C.
PHILIP WATSON
A.M.I.R.E. (Aust.)
W. YASHIN
MERVYN HUDDLESTON

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OUR COVER PICTURE

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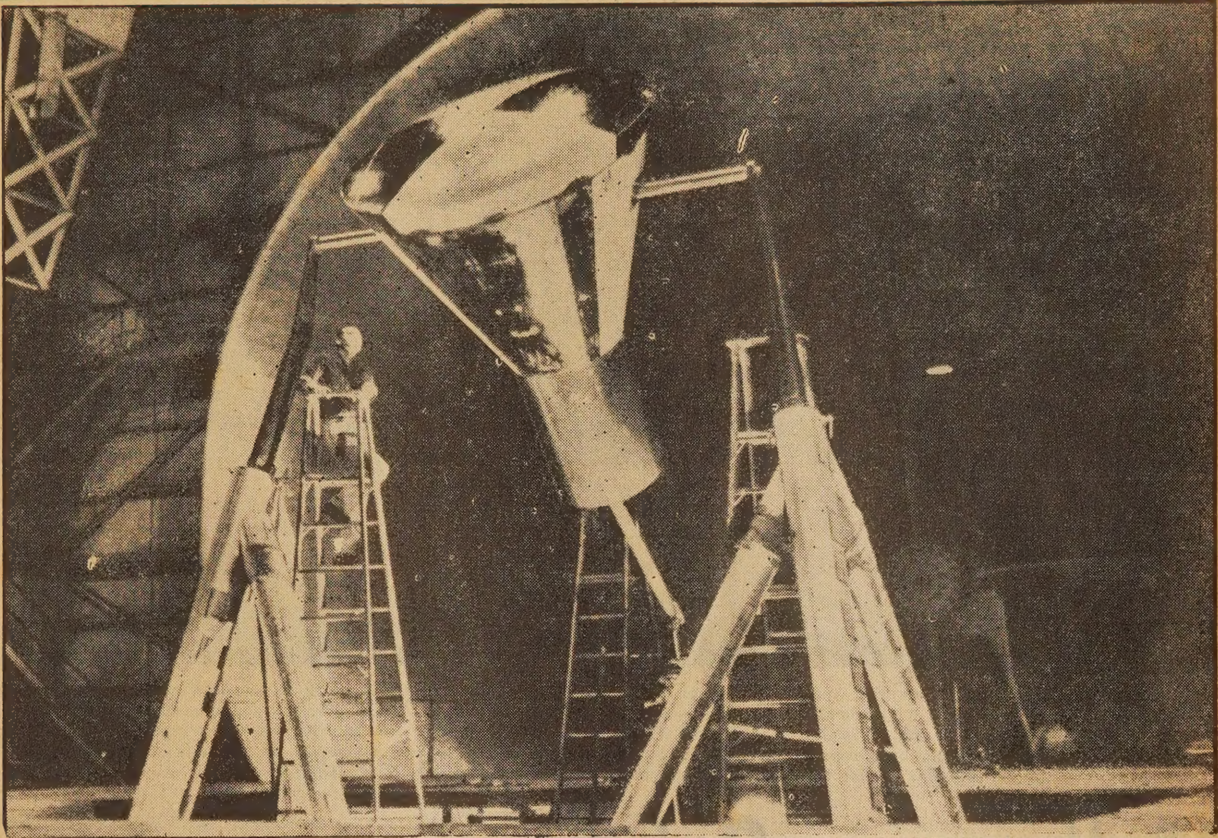
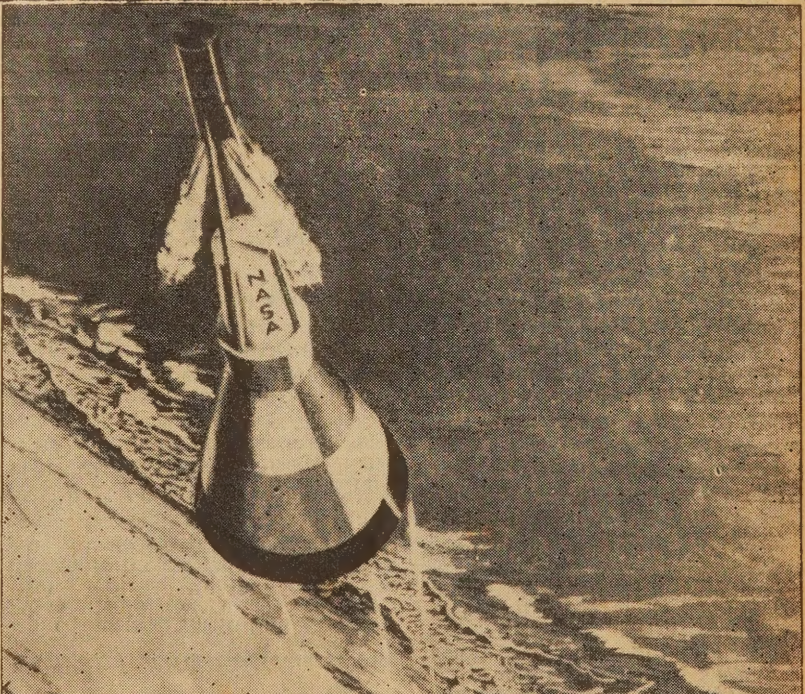
FIRST TEST ON SPACE CAPSULE



The American National Aeronautics and Space Administration Research Centre at Langley Field VA has made extensive tests on the design for a "Mercury" capsule intended for outer space.



PROTOTYPES have been tested for lift, drag and static stability using a specially developed wind tunnel, to evolve the best shape for an orbital vehicle.

The top photograph, which has just been released, shows the prototype in the mouth of the wind tunnel.

The artist's drawing at the right shows test being conducted with the escape system.

In the case of an abortive launching, a rocket on top of the capsule will be fired to ensure elevation to a safe altitude so that it can return to earth by means of parachutes for recovery and the safety of its occupants and contents.

Further experiments have been conducted to observe water landing conditions if those should be encountered.

The capsule, with its protective covering against heat and radiation, will carry a variety of instruments, communications equipment, pressurised living quarters and survival equipment.

High-altitude balloon being filled with hydrogen: part of the work of obtaining data for study of cosmic rays at the University of Melbourne. The balloon is a standard met. balloon which has been fitted with the levelling valve—a simple device developed by Dr Hopper and his team at the University of Melbourne. Photographic plates are carried by the balloon to high altitude and sustained there for some hours before being returned to the earth. The plates are then developed and subjected to microscopic examination for their record of cosmic ray collisions with atoms in the emulsion.

Melbourne Scientist Plots Cosmic Rays

Australian scientists are playing a notable part in research into the incidence and behavior of cosmic rays. Their primary research tool consists of photographic plates which are sent to altitudes of 100,000ft and more, and kept there for some hours, suspended beneath balloons.

By R. Michel

RESULTS gained from this research, which was made possible by the development of an ingenious balloon "valve," have attracted world-wide attention and have won international acclaim for the instigator, Dr V. D Hopper, of Melbourne, and his team.

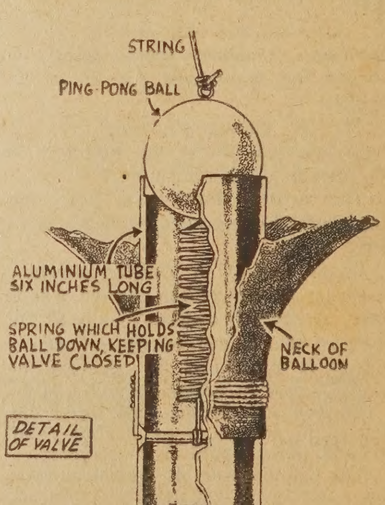
Dr Hopper began the experiments in recording the intensity of cosmic ray bombardment over south-eastern Australia 10 years ago. The purpose was to study the nature of primary cosmic rays coming in at these latitudes.

Similar high-altitude research has been undertaken over some years at many points in the northern hemisphere, but little had been done south of the equator until the Melbourne team began its program of high-altitude balloon flights.

Tracking down cosmic rays is a difficult, time-consuming and costly undertaking. Ever since this form of radiation was first noted just half a century ago, scientists have been directing attention to a study of these extremely penetrating rays. Originally cosmic rays were thought to be a form of gamma rays similar to X-rays, but later experiments have shown them to be made up essentially of particles bombarding the earth's atmosphere with high energy. So far, however, no satisfactory explanation of their origin can be given.

These primary rays coming in from outer space are chiefly protons travelling at various speeds. Many of these collide with air particles, the collisions becoming more frequent in the denser atmosphere at lower altitudes.

The collisions in turn cause the nuclei of atoms that are hit to break into par-


STRING
PING-PONG BALL
ALUMINIUM TUBE SIX INCHES LONG
SPRING WHICH HOLDS BALL DOWN, KEEPING VALVE CLOSED
NECK OF BALLOON
DETAIL OF VALVE

Detail of levelling valve developed by Melbourne University research team for use on balloons.

ticles, including secondary protons, neutrons, mesons and electrons, all of which become secondary cosmic rays.

Further collisions with atomic nuclei are believed to create tertiary and quaternary rays with the process continuing until the energy of the primary ray is dissipated. Some of the energy actually goes into the form of mass in the formation of the meson created.

The very high energies of the particles can be studied by a secondary generation process known as giant showers. Such studies show maximum energies in electron volts to be at least 10,000-million-million and possibly 100,000-million-million. These energies per particle are very great, and as much as 100,000 times as great as those that can be attained in the most powerful accelerating machines.

RADIATION AT SEA LEVEL

The only radiation which reaches sea-level is the secondary radiation produced at high altitudes. Almost none of the primary particles survive the passage through the atmosphere, but the mesons arising from collisions above become the main agency by which the radiation is propagated.

Since the early research in cosmic rays undertaken in Austria about 1911 by Victor Francis Hess and Werner Kohorster, physicists have studied their nature and occurrence in many parts of this world from the depths of lakes, mines, and glacial crevasses to mountain peaks and into the stratosphere.

There is always an element of hide-and-seek in cosmic-ray research. Discovery of the existence of this form of radiation came as a result of the detection of extremely penetrating radiation after all radio-active substances had been removed or had been adequately shielded from the radiation-measuring device. This was done by Hess when he took an ionisation chamber up in a balloon flight. The increased intensity obtained as he ascended was interpreted by Hess as evidence that a penetrating radiation came from outer space—hence the name, cosmic radiation.

NIGHT AND DAY INTENSITIES

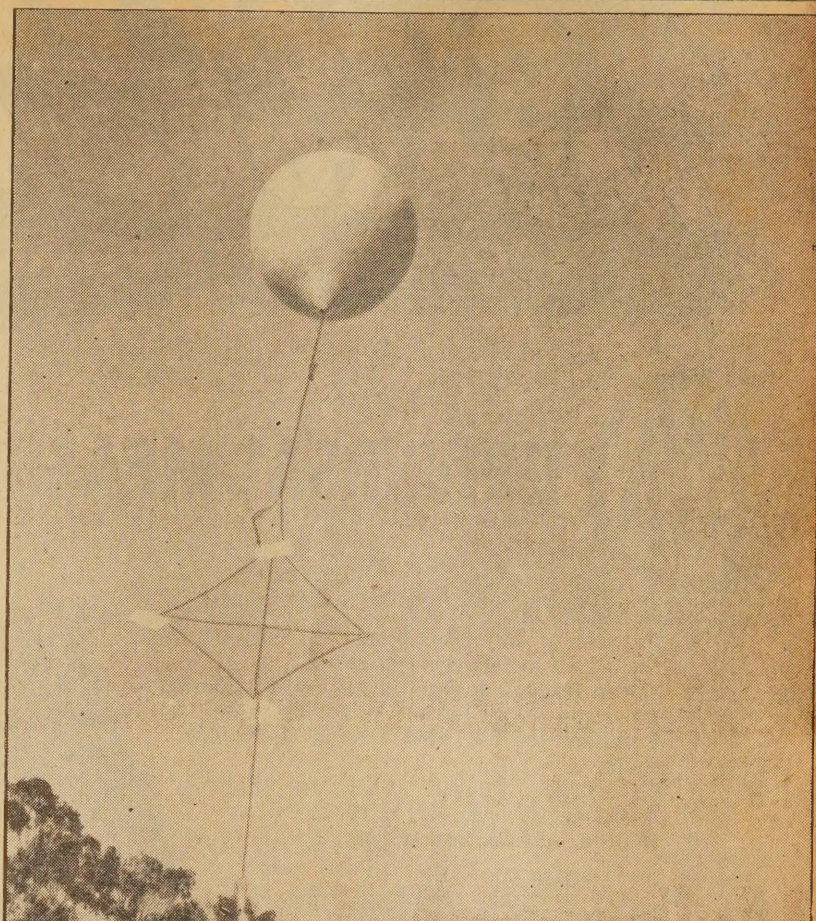
Such radiation, he believed, was dissipated by atmospheric absorption, so that the intensity would increase as the top of the atmosphere was approached. Hess also noted that there was no great difference between nighttime and daytime intensities, thus ruling out the sun as the probable source. The rays' origin was, therefore, presumed to be beyond the solar system.

Cosmic radiation can be detected and measured by different types of detectors. These are:

- **the ionisation chamber,** and **counters,** such as scintillation counters, Geiger counters and Cerenkov counters, all of which yield an electrical impulse when the particle to be detected passes through their sensitive volume;
- **the cloud chamber** and **the bubble chamber,** and **the photographic emulsion,** in which a developable track is left as the record of the actual track of a charged particle in the medium.

It is in the recording of cosmic ray bombardment on photographic emulsions that the most conclusive work has been done. Carried to high altitudes, and held there for some hours, the sensitised emulsions produce striking microscopic "pictures" in full three-dimensional detail in recording individual cosmic ray trails.

HIGH ALTITUDE BALLOON RISES



High altitude balloon fitted with automatic levelling valve, carries cosmic ray plates on its flight over Victoria. Attached to the balloon is a radar target to facilitate tracking of the balloon. A release mechanism for the plates and a parachute to bring them back safely to earth, are part of the apparatus.

Under the microscope the effect is very similar to that which is to be observed in a cloud chamber, except that the atomic "explosions" have been frozen permanently.

Emulsions almost a millimetre thick (1-25th of an inch) require no glass backing, and layers of these can be added to make a solid block of emulsion. Similarly, packs—even as large as a foot cube—can be constructed and exposed to cosmic radiation.

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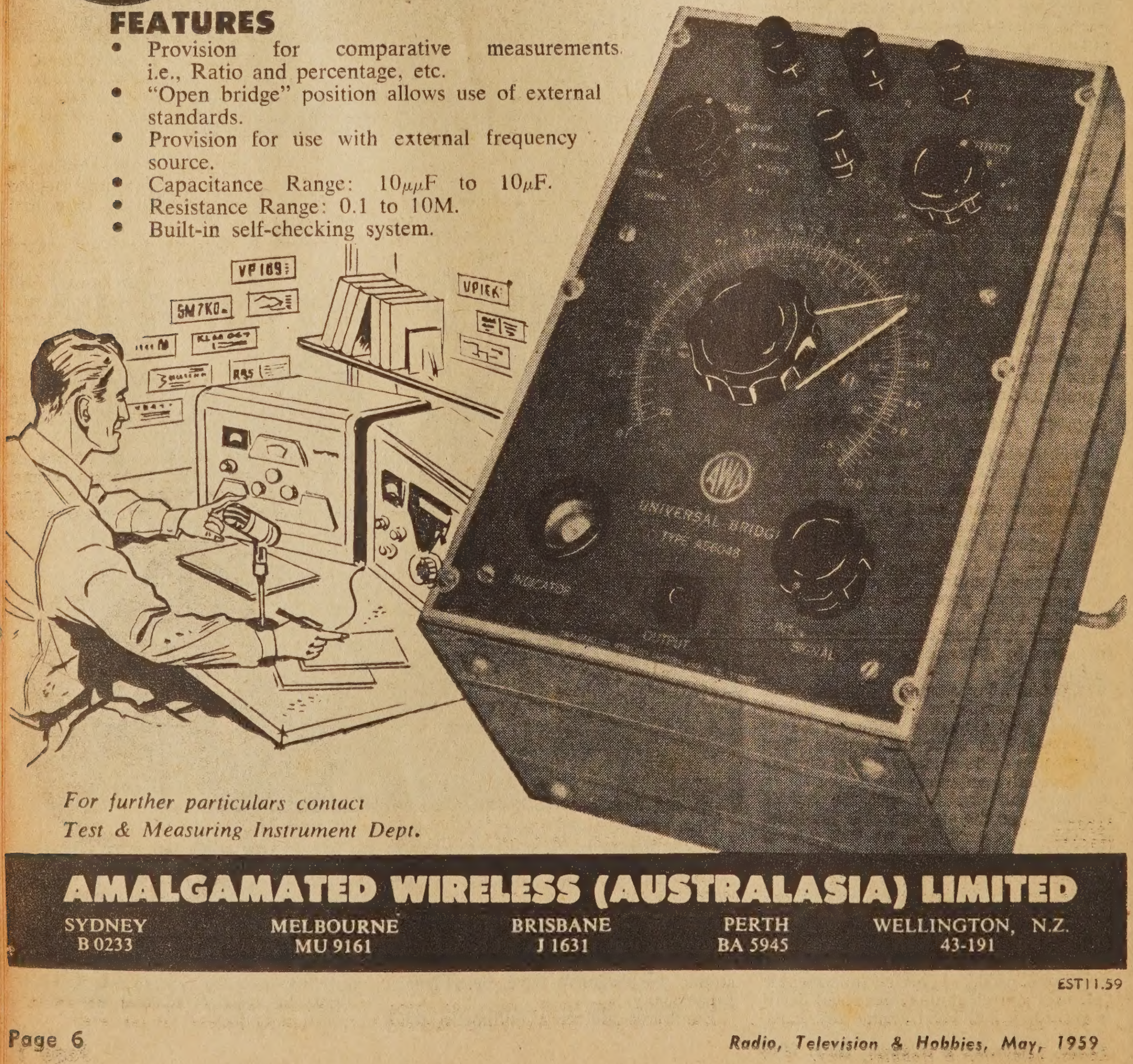
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When a high energy particle hits an atom in the emulsion it either knocks it out of the way, or if it makes a sufficiently close collision it breaks it up and usually frees several protons and neutrons in the process.

These collisions are usually detected in the emulsion as lines spreading out from a point, giving the appearance of an explosion, which is what actually occurs.

Northern Hemisphere experiments have been undertaken generally with large plastic balloons, many of them 100ft or so in diameter, which are capable of carrying good loads to heights of 100,000 or 110,000ft.

SIMPLER METHOD

The problem here in Australia was to find a simpler and cheaper vehicle. The answer was found in the use of standard meteorological balloons for which a levelling device was developed to give them an operational range generally higher than that of the balloons in use overseas. The load is smaller, but the exposure time of several hours at high altitudes—a vital factor—is as great as that gained with the larger and more expensive balloons.

The levelling device is a valve which allows gas to escape when the balloon reaches a predetermined altitude. As a balloon rises into a more and more rarefied atmosphere the gas in it causes it to expand steadily until bursting point is reached.

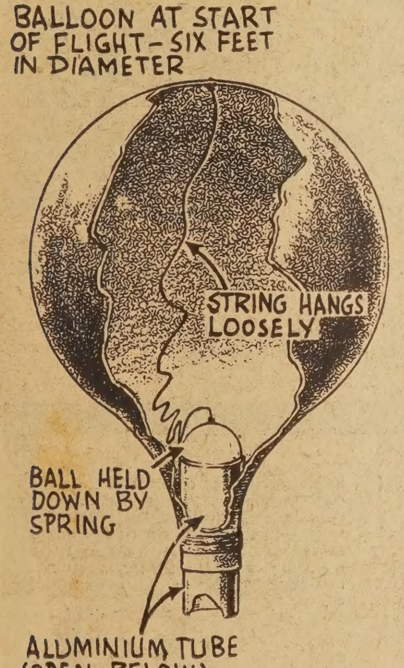
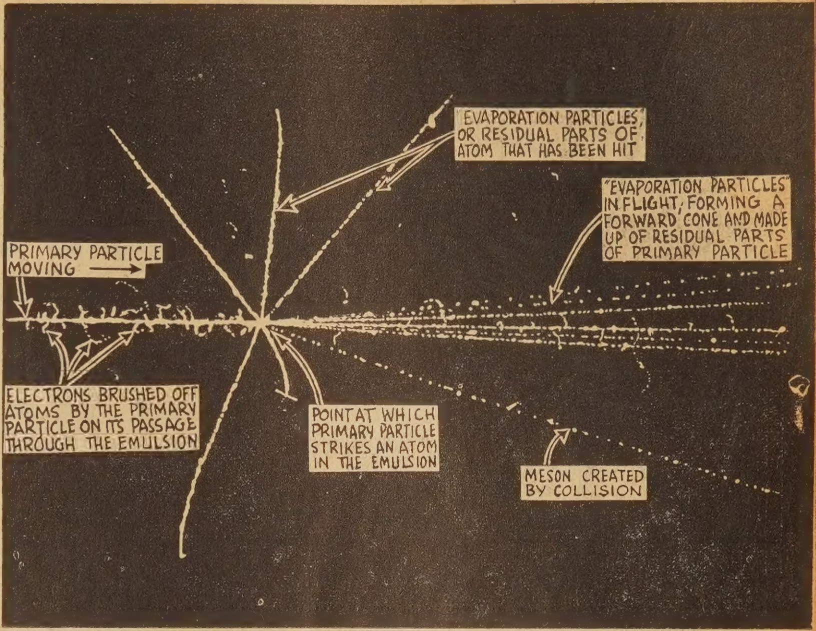

BALLOON AT START OF FLIGHT - SIX FEET IN DIAMETER
STRING HANGS LOOSELY
BALL HELD DOWN BY SPRING
ALUMINIUM TUBE (OPEN BELOW)

Diagram-sketch of levelling device in use on balloon (at high altitude, with valve open).

The valve that the Melbourne team developed for its purpose is an extremely simple device. It consists of six inches of aluminium tube about 1½in in diameter, closed at one end by a ping-pong ball, which is held down by a light spring fixed inside the tube. The valve is fitted into the neck of the balloon with the ball end inside the balloon.

PICTURE OF ATOMIC EXPLOSION


"EVAPORATION PARTICLES", OR RESIDUAL PARTS OF ATOM THAT HAS BEEN HIT
"EVAPORATION PARTICLES" IN FLIGHT, FORMING A FORWARD CONE AND MADE UP OF RESIDUAL PARTS OF PRIMARY PARTICLE
PRIMARY PARTICLE MOVING →
ELECTRONS BRUSHED OFF ATOMS BY THE PRIMARY PARTICLE ON ITS PASSAGE THROUGH THE EMULSION
POINT AT WHICH PRIMARY PARTICLE STRIKES AN ATOM IN THE EMULSION
MESON CREATED BY COLLISION

MICROSCOPIC VIEW OF AN ATOM EXPLOSION PRODUCED BY A COSMIC RAY: A primary cosmic ray particle collides with an atom in a photographic emulsion. This microscopic evidence (here greatly magnified) shows how the particle breaks up as a result of the impact, forming a cone (right), and the atom in the emulsion explodes, producing a shower of residual parts.

A string inside the balloon goes from the top of the ball to a point immediately opposite the neck. When the balloon expands in the rarefied atmosphere to a diameter corresponding to the length of the string, the valve opens and starts letting gas out. However, the balloon keeps climbing until only sufficient gas is in it to balance the weight of the balloon and its load. This means that the balloon floats at a definite (and predetermined) height. The length of the string is adjusted to govern the altitude. Use of the automatic gas release valve allows the balloon to climb 20,000ft, or even 30,000ft, above its normal bursting point. On a standard balloon, with a gas volume of 2,400 grams lift, about half the gas escapes, so that the ratio of pressure at the point where the valve first opens when the balloon finally levels is 1 to 2.

HIGH ALTITUDES

In practice it has been found possible to use a string length of 23ft 6in with the standard met. balloons. The altitude reached and maintained for some hours is about 115,000ft.

This compares more than favourably with flights by other methods.

According to a predetermined schedule, a clock finally releases the "load" which floats back to earth.

When recovered, the plates are developed and under microscopic examination they usually reveal the effects of cosmic rays that have passed through them.

The results confirm the general observations made elsewhere, showing that the primary rays are nearly all protons (92 per cent), with a few alpha particles (7.5 per cent), and a still smaller number of heavier nuclei (about 0.5 per cent).

By using emulsion that has been soaked in water before being exposed to cosmic radiation, the Melbourne scientists have developed a new method of recording cosmic ray collisions and their effects.

For special purposes, plates are soaked and swollen to anything from three to nine times their normal thickness. Still wet, they are sent aloft, and it is possible to record the effect to the interaction of cosmic ray particles with water as well as with the emulsion.

There are gains in being able to study the effect of the secondary radiation which follows the collision of the primary particle.

Of particular value is the record of particle collision with hydrogen atoms. This extends the range of study normally available only in man-made atom-

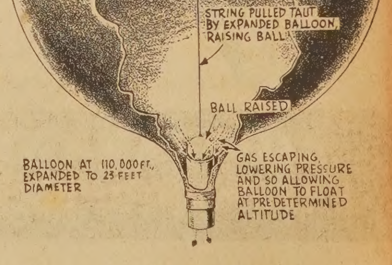
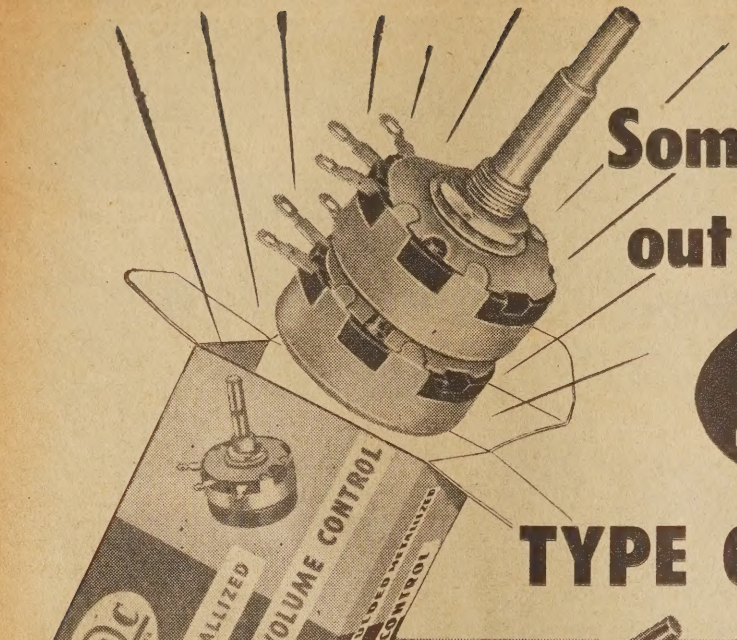

STRING ATTACHED TO BALLOON AT POINT OPPOSITE NECK
STRING PULLED TAUT BY EXPANDED BALLOON, RAISING BALL
BALL RAISED
BALLOON AT 110,000FT., EXPANDED TO 25 FEET DIAMETER
GAS ESCAPING, LOWERING PRESSURE AND SO ALLOWING BALLOON TO FLOAT AT PREDETERMINED ALTITUDE

Diagram-sketch of levelling device in use on balloon (at sea level).



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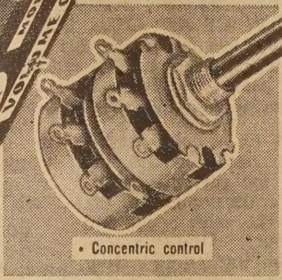
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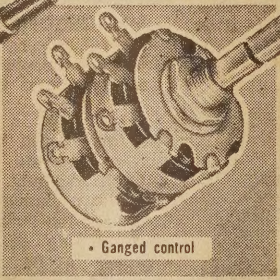
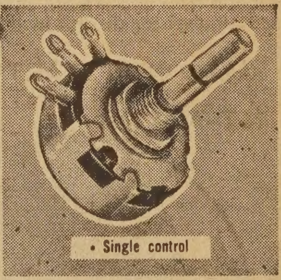

• Ganged control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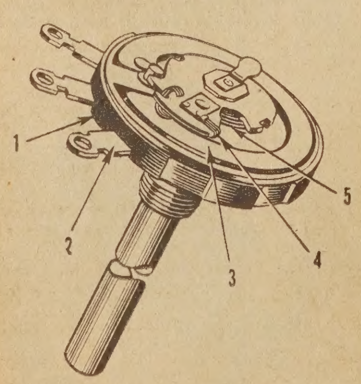

1 **The IRC control base** is precision-moulded of high-strength, low-moisture-absorption bakelite. This ensures that other parts remain accurately aligned.

2 **Terminating lugs** are all heavily plated for ease of soldering and positive connection to the element is ensured by riveting. The riveted lugs, unlike pressure-contact types will not loosen with soldering and the terminals may be bent for wiring to any convenient position without the control becoming noisy.

3 **Resistance element** of metallised coating bonded to bakelite is cured and seasoned at high temperatures. The result is a smooth, low-noise-level element, extremely hard and resistant to humidity and ageing effects. The flat strip principle enables the production of elements which conform more closely to the eight published curves than is possible with solid carbon tracks. By virtue of the physical size, the CS element therefore has a greater power dissipation with lower temperature rise than with other types.

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smashers, for the method that Dr Hopper's team has introduced means that the physicist now has another way of studying a proton collision—and in a form not previously possible.

Interactions with hydrogen are particularly significant as the theory of collision of hydrogen with atoms has been carefully studied earlier and the reverse process, namely the collision of an atom with hydrogen, may be used to yield important data. The atom explodes in flight and the pieces move forward in the shape of a cone, and from the angle of the cone the energy of the original particle can be estimated.

It is therefore possible to determine the energy spectrum and the mass spectrum of the primary particles coming in at the point of observation.

Generally, the purpose of the research being undertaken is to provide more basic information on the energy of cosmic rays that impinge upon the earth at these latitudes.

DIFFICULT TO RECOVER

Because of the impossibility of recapturing the exposed plates, no effort has yet been made to extend the work to Antarctica. Physicists are particularly anxious to get a "sampling" from the region but so far the practical difficulties of recovery have proved insuperable.

The number of rays arriving at the top of the earth's atmosphere is believed to be about 0.34 per square centimetre per second in latitudes near the poles, while a substantially lower number comes in lower latitudes.

Variations in the primary radiation that can be correlated with magnetic storms and with solar disturbances are known to exist, and in addition there are irregular and as yet unexplained variations.

The magnetic storm effect occurs when sudden "storms" in the earth's magnetic field alter the amount of deflection experienced by the arriving radiation.

Study of the effects of solar disturbances on cosmic radiation is still inconclusive. It is now directed largely towards assessing the possible effects of inhibiting factors that may arise from solar radiation.

ANOMALIES

Variations from the theoretical pattern of cosmic ray intensity — known to the scientist as "anomalies" — are known to occur at various points in the Southern Hemisphere, and Dr Hopper is now preparing to study some of them.

In July he will transfer his activities to South Africa. A Nuffield grant has been made so that he and his team can set up the research unit and undertake about six months' experimental study there, working in association with South African meteorological experts.

With that study concluded, Dr Hopper hopes to extend his studies to South America.

The primary purpose of the South African research will be to determine cosmic ray intensities, but both there and possibly in South America he expects also to undertake extensive new work on upper winds — a field in which only preliminary study has yet been undertaken in the Southern Hemisphere.

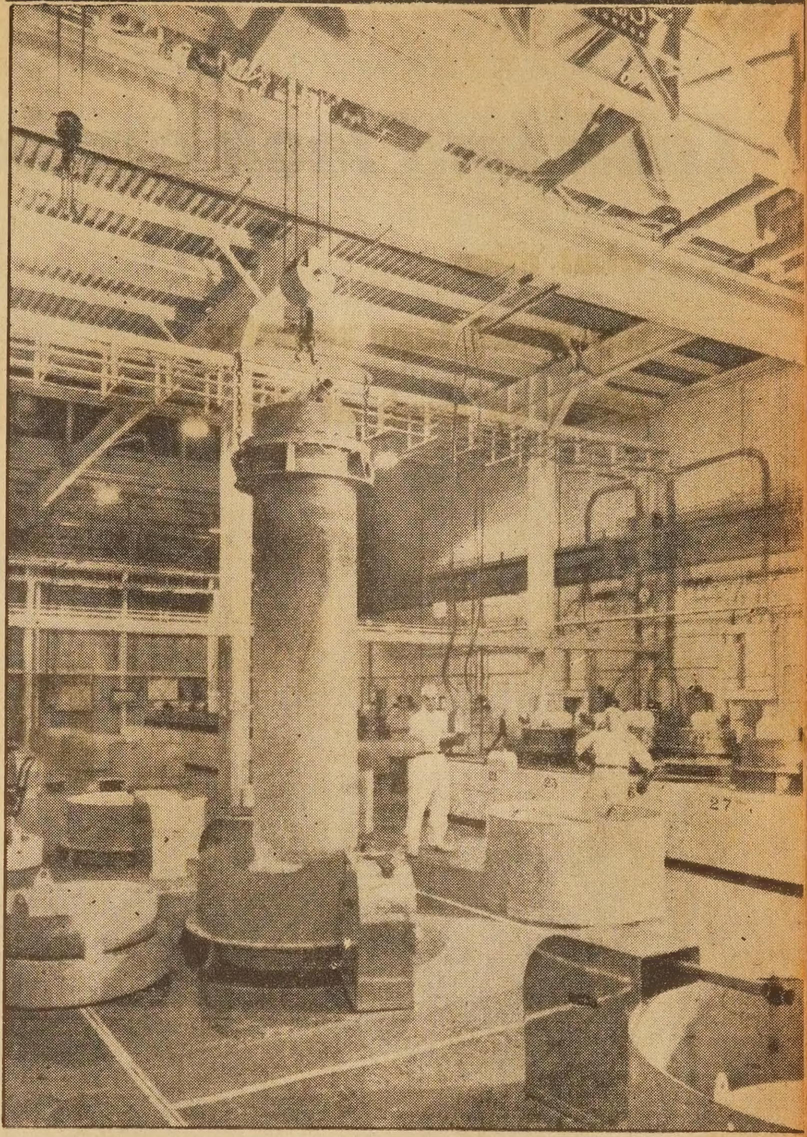
During the International Geophysical Year the Australian Bureau of Meteorology adapted the valve technique for weather balloons. Some 500 balloons have reached heights above 100,000ft. This has enabled sufficient information to be obtained on the winds at high altitudes to indicate the existence of patterns in upper winds which may be a significant pointer to weather factors.

It has already been established that air movement patterns at upper levels (above 70,000ft) are quite distinct from conditions at lower levels. Normally, winds at such levels form "rivers of air" which are fairly constant in direction and strength for periods of up to some months. Occasionally quite definite abnormalities occur, and these, it is thought, may be a pointer to important changes at lower altitudes where our "weather" is made.

Little more can be done in use of existing data, however, until a clearer picture of upper winds over the Southern Hemisphere is known. Further measure-

(Continued on Page 103)

URANIUM FOR ATOM POWER RODS



A red-hot reactor is lifted from a furnace at Britain's uranium factory at Springfields, near Preston, Lancashire.

The furnace is used to heat a mixture of magnesium and uranium tetrafluoride, causing a chemical reaction in which the magnesium combines with the fluorine and the uranium is reduced to its metallic form.

The factory, which started production in 1948, turns crude uranium oxide into the uranium rods, which provide the core of atomic furnaces generating the energy turned into electricity for homes and factories through Britain.

Most of the crude material is supplied from South Africa, but increasing supplies are coming from Canada and Australia.

Nearly a million uranium rods have been produced at Springfields, where equipment already worth many millions of pounds is still being augmented to meet increasing demands.

By 1966 about a quarter of Britain's electricity will be produced from atomic sources, and a large atomic power station being built in Italy is expected to be the first of several constructed overseas by British firms.

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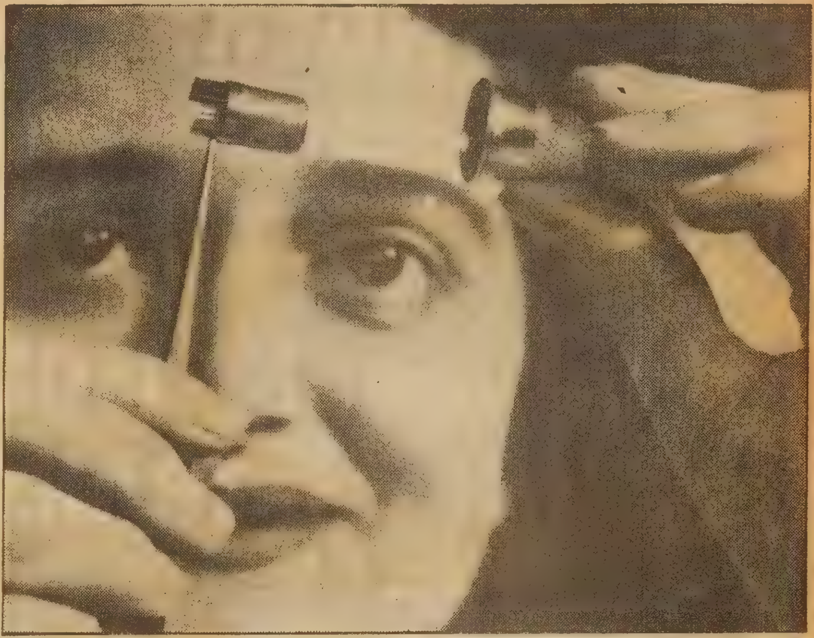
P 1345.59

NEW VALVES ARE THIMBLE SIZE

HIGHLY RESISTANT TO HEAT AND COLD

Any major valve design sponsored by R.C.A. is bound to have a big effect on the valve industry as a whole. Thus these preliminary details of an entirely new type of miniature valve must be read with particular interest, particularly by those who believe that valves have no future.



Holding a Nuvistor in a pair of tweezers, this operator illustrates their size as compared with that of an ordinary thimble. The new type valve is expected, when universally available, to find many applications in electronics generally

A REVOLUTIONARY development in electron valve design, hailed as one of the most significant advances in valve history, was announced recently by the Radio Corporation of America.

"Development of the new design represents a major breakthrough in tube size, performance, power drain, and reliability," said D. Y. Smith, vice-president and general manager, R.C.A. Electron Tube Division. "It opens the way to mass production of high performance, thimble-size valves having improved ruggedness, reliability and efficiency."

Called "Nuvistors," the valves could lead to new electronic developments in such instruments as television sets, communications receivers, and computers, as well as more compact and efficient electronic equipment for defence and industry.

FUTURE OF VALVES

Prototypes are now in advanced development stages.

Electron valves, according to R.C.A., have by no means reached the limit of their low-cost, high-performance capabilities. Through the study of new materials, new processes and new techniques, engineers have not only developed the Nuvistor, but foresee the practicality of even smaller types having power consumption reduced to one-twentieth the power required for conventional tubes. They anticipate that receiving valves of the Nuvistor design can have useful lifetimes of tens or even hundreds of thousands of hours.

The name of the new design is based on the words "nueva," meaning new, and "vista," meaning prospect. Hence, the "new look" or "Nuvistor."

Developmental samples of the "new look" valves will be available to the electronics industry within the next several months.

AVAILABLE TYPES

A small-signal triode and a small-signal tetrode will be offered at first, and will be followed later by a beam power valve. According to present plans, R.C.A. expects to start limited commercial production of Nuvistor tubes in 1960.

Recent demonstrations showed a completely "nuvistorised" tuner unit of a television set in operation, which required only a fraction of the plate voltage required by conventional tuners. This experimental tuner, believed to be among the smallest ever designed for TV receivers, reduces the over-all volume of conventional units by approximately one-third.

The ruggedness of the Nuvistor design was displayed in several torture and endurance tests. It continued to function normally in an electronic circuit when placed alternately in the heating coils of a special furnace (60 degrees Fahrenheit) and in liquid nitrogen (320 degrees below zero F.). In another demonstration, the valves were shown operating continuously in both the special furnace and in liquid nitrogen. Operation of the Nuvistors was not disturbed by a guillotine-type device which repeatedly subjected them to severe mechanical blows.

These experiments, as well as other rigorously controlled laboratory tests, illustrate the high-temperature capabilities of Nuvistors as well as their reliable performance under conditions of severe shock and continuous vibration.

These features, plus compactness and high efficiency, will make the Nuvistor ideal for many types of military and airborne electronic systems. Modern jets, guided missiles, and military vehicles all require sturdy, rugged, and compact electronic components capable of reliable, efficient performance.

Because the tiny valves have improved electrical and thermal characteristics as well as improved reliability, the Nuvistor should find a ready market in the television industry.

ADVANTAGES CLAIMED FOR NUVISTOR

- Small size, no larger than a thimble.
- Resists temperatures from 660 to minus 320 degrees F.
- Extreme mechanical stability.
- Low element voltages.
- Greatly increased life.
- Low cost.

USE IN TV

The small-signal triode and small-signal tetrode, already well along in advanced development, will be of particular interest for TV tuner designs and intermediate-frequency amplifiers in view of their small size and excellent electrical characteristics. The beam power valve, now being worked on, is especially well suited for audio output and horizontal-deflection applications in television sets.

Nuvistor tubes are also expected to offer many advantages for high-speed data-processing equipment.

The new small, high-efficiency triodes and tetrodes will find wide use in the logic and computing circuits of electronic computers. The power tetrode, capable of high peak current at low plate voltage, offers advantages for memory-core-driver applications, an important operation in which information is stored for later use.

The beam power valve could be utilised in series voltage regulators, low-power transmitters, servo amplifiers, and high-power sound systems for a wide

(Continued on Page 21)

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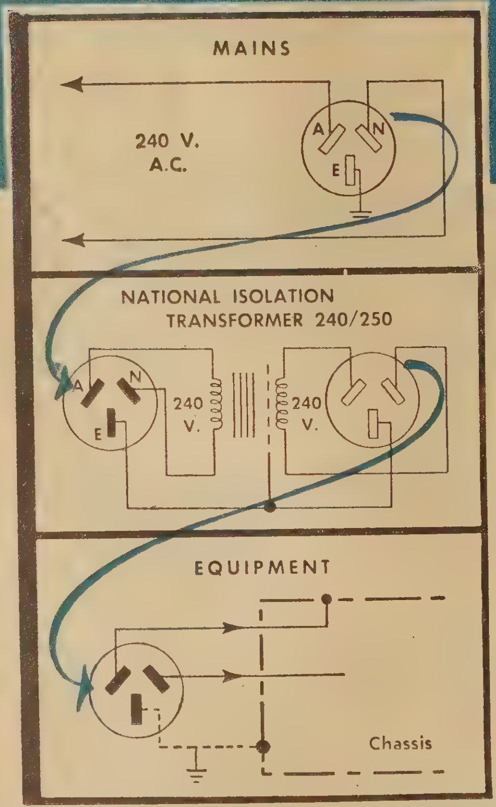
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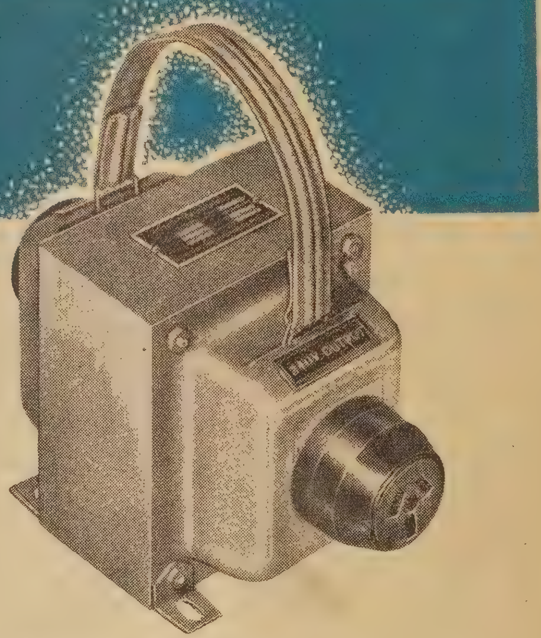

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MORE ON ELECTRO-LUMINESCENCE

SIX COLOURS NOW AVAILABLE IN NEW TECHNIQUE

Development of electroluminescent panels that emit a soft glow of light in any one of six specific colours—instead of the single green colour heretofore achieved—has been successfully carried out by R.C.A. The panels have possible uses in many fields, such as in vari-coloured displays for holidays or for merchandising, house numbers that glow in the dark, night lights within the home and softly lit instrument panels for many applications, particularly where varied colours might be helpful.

DEVELOPMENT of these different-colour light panels is considered to be a significant breakthrough in the new field of electroluminescence. We can now have panels of good brightness in greenish yellow, deep yellow, deep blue and white. The colour red is produced in electroluminescent panels by means of supplementary luminescent material.

Electroluminescence is a phenomenon of electronics—the emission of light by a phosphor material excited by a varying electric field. In this case, the panel phosphor gives off light when excited by an alternating voltage.

An electroluminescent or "EL" panel possesses the distinctive advantage of producing a glare-free, cool light emanating from a flat area. In addition, the panel has long life and low power consumption.

COMPOSITION OF PANELS

The panels, now in the final refinement stage in the laboratories, are pieces of specially coated glass or metal. Their development came as a direct result of extensive research by engineers working on tubes for colour television sets.

The panels produced for experimental laboratory purposes are 2in square, but they can be made in larger sizes to meet individual requirements.

Each panel consists of an extremely thin layer of electroluminescent phosphor (two thousandths of an inch) which is applied on a glass plate approximately one-eighth of an inch thick. When an alternating voltage is applied to the panels, they glow in soft colour tones. The brightness of the different colour panels depends on the colour of the panel type as well as the applied operating voltage and the frequency. The panels are operated on alternating voltage, either 120 volt or 240 volt, depending on the type.

Some of the more obvious applications for eletro-luminescent lighting include number peaks, motor car dashboards, clocks and steps in dark places.

Basically, the panel is similar to a capacitor since it has a sandwich-type construction made up of two conductors on either side of the electroluminescent material. One of these conductors or electrodes is transparent to permit the passage of light from the panel. A very thin reflecting metal backing serves as the other electrode.

The magic elements that make electroluminescent panels possible are copper and the halides. By careful combination of these elements with other elements, research workers have been able to develop a variety of materials, each having a distinctive colour of emitted light.

VARIOUS TYPES

In addition to the plain colour panels, RCA has under development two types that are more elaborate.

One is a segmented figure 8 in block form which can be triggered to light up any number, zero through nine, by applying voltages to the proper segments. Measuring 1in wide and 1½in high, this type can be combined in a strip to provide a number of up to eight digits. These numeric panels may be utilised wherever an illuminated display of changing numbers is required, such as in cash registers, counting devices and computers.

The second type, known as an X-Y co-ordinate panel, produces a luminescent pattern. It resembles a small checkerboard, with closely spaced, hair-thin, transparent line-electrodes backed by a solid electroluminescent layer. Another series of aluminium lines, at right angles to the other lines, serve as a second group of electrodes. When voltage is applied between one horizontal line and one vertical line, the crossover of these electrodes is illuminated. Several crossovers, simultaneously lighted, produce a pattern.

RCA expects that its X-Y co-ordinate panel will be utilised for special read-out and display devices in combination with image storage equipment. In addition, it could find applications in electronic computers.

All three development panels are being made available to interested equipment manufacturers for experimental use

In Stourbridge, England, the arts of glass making are handed on by the master craftsmen. Here a young apprentice is being shown how to grind patterns into a crystal vase.

Glass Surrounds Us While We Live

The ever expanding list of new types of glass and the use to which they are put makes a romantic story of scientific achievement. Many scientists forecast that even aircraft may some day be made of glass.

by Calvin Walters

ALTHOUGH the people of the civilised world spend most of their time behind glass, it has become so commonplace that nobody notices it.

Millions of people all over the world live and work and sleep behind glass windows. Out in the street vast numbers of people wear spectacles. If there is nothing wrong with their eyes a lot of people wear spectacles just the same for the effect of it.

Most people are familiar with glass only as windows, spectacles, bottles, jars, tumblers or ornaments.

Bottles are a very familiar sight everywhere. They are seen on shelves and in refrigerators. They are carried about in suitcases and sugar bags. They abound in rubbish dumps or are seen lying in the grass in parks or floating as dead marines in harbours and rivers.

More glass is used making bottles than for any other purpose. The making of bottles is only the low side of glass manufacture and use, although to see bottles rolling out of a modern glass plant is a wonderful sight indeed.

Nobody seems to know exactly when glass was discovered. It is known that as far back as 5,000 B.C. the method of fusing silica into glass was well enough known and that ornaments and weapons were wrought from this substance.

The Roman historian Pliny put a story around that glass was first discovered by some sailors who were shipwrecked on a sea shore. In order to form a support for their cooking pots they used blocks of soda set upon the sandy beach. When the fire was well alight the sailors noticed molten glass running out from beneath the fire. The silica of the sand had combined with the soda thus forming glass.

Now Pliny was no chemist, otherwise he would have known that to fuse silica and soda requires a temperature of about 1,300 degrees and no ordinary wood fire would produce such a heat. His story is therefore out of order.

Ancient people used a natural glass called obsidian from which to form weapons.

OBSIDIAN DEPOSITS

Obsidian is a glass formed by volcanic action. It is dark, brittle and extremely tough. Huge deposits are found in various parts of the world and it is natural that early man would make use of it to fashion his spear and arrowheads.

It was fashioned by using small pieces as chippers. Later on early man found that if he heated the obsidian and dropped water on to it, it would break off into small pieces. In this way he was able to shape the obsidian into ornaments which he highly prized.

Many centuries B.C. glass was being manufactured. The main centre of manufacture was Egypt. Even the method of colouring by the addition of various metals was used. The metals used were mainly copper, magnesium and cobalt.

Getting back to the bottle question again for a moment it is interesting to note that the ancient Egyptians found that their clay wine and water bottles could be made leak-proof by coating the outside with a film of glass.

By coating the outside of the clay with a combination of soda and silica and then baking it in an oven the silica and soda fused into glass all over the outside of the bottle.

This silica and soda method has thus been handed down from antiquity and is in use today for making the greater proportion of glass now in use.

Certain modifications have, of course, been introduced, but the process is essentially the same today as it was centuries ago. It consists merely of the mixing of sand, soda and lime in correct proportions and melting it in a furnace.

Furnaces have, of course, been considerably improved with the result that millions of bottles (again), electric lamp bulbs, table glassware, building blocks, in addition to acres of window glass are produced annually from this kind of glass.

Glass, unlike most solid substances,

is non crystalline. In fact, part of the glassmaker's task is to prevent crystals forming in glass.

Why is glass brittle? The reason lies in the characteristic of molten glass of not passing suddenly from the molten to the solid state. As the molten liquid solidifies it is the outer parts which solidify first followed by the inner parts. Thus, the inner and outer molecules do not cohere at the same time. The mass is therefore full of internal stresses which accounts for the brittleness of glass.

On the other hand, it is fatal to glass manufacture to have the mass cool too suddenly, for then there is a danger of crystals forming inside the mass. These may be crystals of soda and silica and, as crystals tend to continue growing, the glass would finally shatter under the strains set up by the growing crystals.

Pretty as a picture, this girl checks the purity of the sand which has been sifted through a fine sieve. Previously imported from France and Holland, much of the sand now comes from Loch Aline in Scotland for processing in England.

SILICATE COMBINATIONS

Different kinds of glass are made by varying the combination of silicates. There is the combination of silica, soda and lime just talked about. Flint glass is made from silica, potash and lead. Common glass is made from silica, lime and alumina or silica, soda and iron or manganese.

Next to soda glass, the lead glasses are the most common in use. By the addition of a large amount of oxide of lead a glass is produced which is easily melted and worked and has a high resistance to electricity. Lead glass also has a high refractive index giving it a high lustre.

Lead glass is used for making radio valves, TV picture tubes, fluorescent tubes and insulators.

Glass is easily coloured by the addition of various metals. Only traces of the metal are sufficient for the purpose and some very beautiful colours are obtained in this manner.

Cobalt or copper gives a vivid blue. Manganese gives purple and uranium makes yellow green. Copper and gold combined gives either deep red, or according to the proportions, a bright green.

If nickel oxide is used a violet-tinted glass is produced which is opaque to ordinary light but is transparent to ultra violet light.

The kind of glass known as Pyrex is made by adding boron to a glass mixture. This is known as borosilicate glass and is now in wide use because of its high resistance to fracture.

RESISTANCE TO HEAT

This type of glass is used for cooking utensils, chemical laboratory apparatus, water level gauges for boilers, dairy piping, windows in ovens and pipelines for corrosive liquids. It can be heated and immediately plunged into cold water without fracturing.

Another type of glass even more astounding in its resistance to sudden differences in temperature has been developed in America by the Corning Corporation. This is called Vycor glass.

The discovery of this glass was made possible by the observations of a couple of members of the Corning company's staff.

These two noticed that certain glasses which contained a high percentage of borosilicate were peculiarly affected by a certain acid.

This acid had the effect of eating portion of the glass away whilst leaving other portions unscathed. The glass which remained was almost pure silica permeated with millions of microscopic holes. After treatment with the acid, this remaining silica glass was just as strong as before and retained its shape.

Strangely enough this glass will absorb water from the air. When the absorbent glass residue is heated to just below melting point it shrinks and the microscopic holes close up. But although the shape would be about one-third smaller than the original it will still retain its original shape.

The fearsome face of a glass blower as he applies the big blow needed to make glass tubes up to 100ft in length.

The final results of this treatment are remarkable and the glass has made its appearance in some very important applications.

Vycor glass can be heated to nearly 2,000 degrees Fahrenheit without melting or cracking. It can be cooled to freezing point and be plunged into molten metal without cracking. It will not be affected if it is heated to red heat and plunged into ice water.

Small wonder then that Vycor glass was seized upon to make such items as heating elements for stoves. In these, gas burners are replaced with infra red heating units. A great advantage of this type of heater is the fact that liquids can be spilled on them without damage to the glass and the instantaneous heat from the infra red unit is very penetrating with a resultant speeding up of cooking.

GLASS SPRINGS

While ancient civilisations are often given credit for wonder inventions we can wager that they never thought of making springs from glass.

This is actually being done today and the result is a spring which is far more efficient than the conventional metal spring.

The secret of glass spring making lies in the annealing process. Carefully governed controls heat the glass to a vital temperature for a critical period. The following cooling process is just as carefully controlled with the result that the

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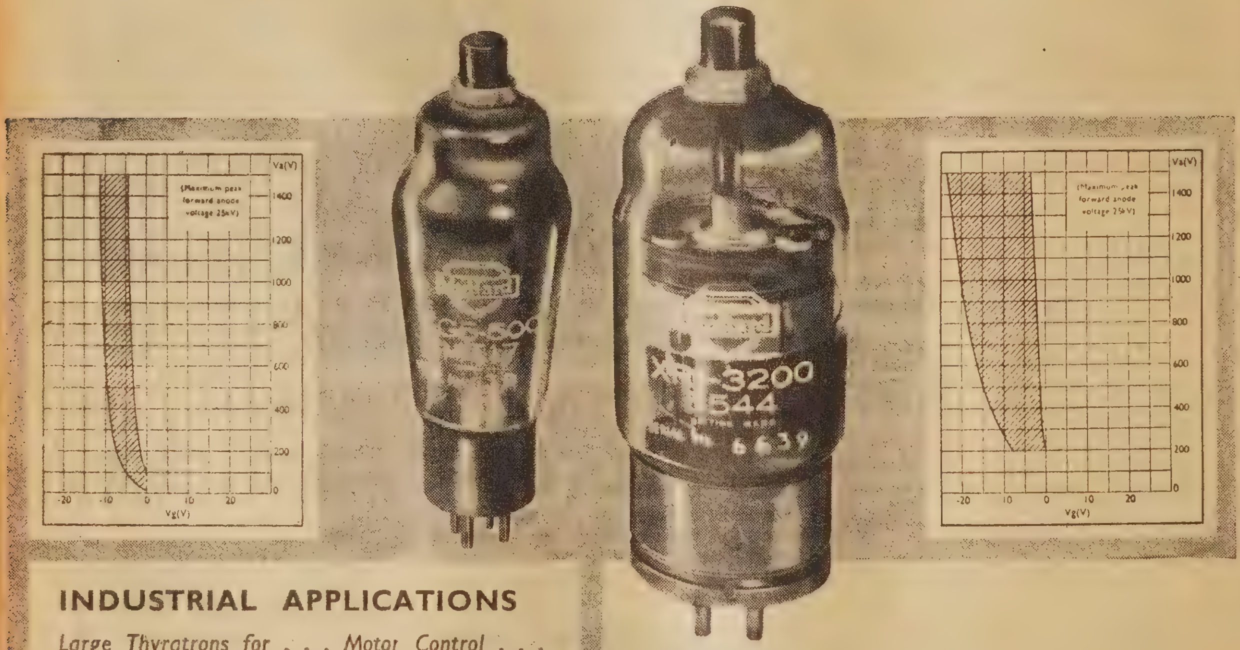

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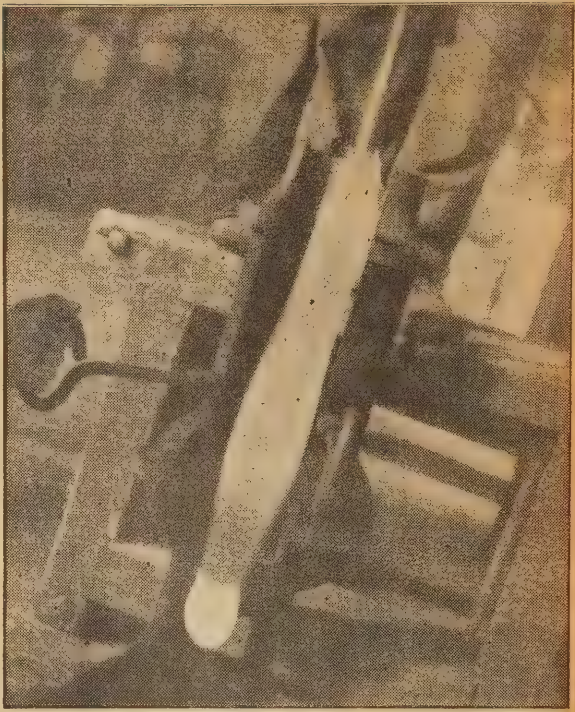
As many as 70 different sized copper cutters are used to engrave glass, ranging from a pin-head to 8 inches in diameter. Patterns such as that shown here take many hours to produce.



A glass article is blown in this mould, coated internally with carbon to act as a lubricant. The blower blows up the glass rotating the blow pipe until it is shaped and set.

glass is entirely free from internal strains. The glass is therefore not brittle and will withstand impacts which would shatter ordinary glass or even metal springs.

Being non-crystalline it will return to its original position after it is bent because there are no crystals to slip and change position.

One of these glass springs has been enclosed in a container from which all the air has been withdrawn. The spring had a weight attached and after setting it in motion it flexed up and down for years without having any further assistance.

Although rather expensive, glass tumblers are made from this type of glass which can be dropped on to a hard floor without breaking.

The so-called opal glass used in fluorescent tubes and electric light bulbs is an interesting product. Although this glass appears to be white in colour it is really clear. The opal effect is brought about by the incorporation into the glass of certain substances which have a different refractive index to the glass.

These substances, usually fluorides diffract the light waves and cause the opalescent appearance.

LIGHT-SENSITIVE GLASS

A remarkable development in the U.S.A. has created a light-sensitive glass used for making permanent photographs.

Incorporated in the glass is a substance which is sensitive to ultra violet light. When a photographic negative is placed in contact with this glass plate and exposed to ultra violet light a latent photograph is impressed into the glass.

The glass is then placed in an oven and heated to 1,200 degrees Fahrenheit. This develops the photograph which is permanent and lasts as long as the glass. The desired depth of tone is governed by the length of time the plate is heat treated.

This process is now being extensively used to make glass printing plates which are far superior to the orthodox metal plates because of their long lasting qualities and ability to capture a more faithful reproduction of the original.

ETCHING PROCESS

The method used to make the plates is one of etching similar to that used in making metal printing plates. The photograph is developed in the glass as described above and the unwanted portions of the picture are etched away with acids. This leaves the wanted portions standing above the surrounding glass.

Modern cameras and binoculars have lenses which are coated with metal in order to reduce reflections from the front.

To get this metal coating on to the glass, the latter, whether it be a lens or a flat sheet of window glass, is placed in a vacuum chamber. The metal is volatilised by means of an electric arc and the metal vapour settles on the glass where it condenses into a very thin film only molecules thick. The film, of course, is absolutely transparent but breaks up all light rays caused by reflections and acts as a screen to all indirect rays.

Sometimes the so-called invisible shop windows are coated in this way for the same reason. They will not reflect to the observer any rays falling on the front of the glass. Other "invisible" windows are merely curved in such a way that no light is reflected from the front surface.

Optical glass used in telescopes and similar instruments must be as perfect as it is possible to make it. It must be free from any kind of imperfection such as bubbles, twists and inequalities which will distort the image coming through the glass to the eye.

This glass is made from a mixture of sand, boric acid, borax, soda ash, saltpetre, zinc oxide, arsenic oxide and potash.

This mixture is melted in a furnace, with heat and time carefully controlled by electronic devices. The molten glass is stirred until it is cooled to a certain thickness (after, of course, it is removed from the furnace), covered with an insulating blanket and cooled slowly for three days. During this cooling, the glass breaks into large pieces.

These pieces can then be broken into smaller sizes for convenient handling They are gradually heated to a point just below softening. The piece is then picked up with an instrument and held in a furnace until it is just about to melt It is then held over a mould and the required sized piece cut off with shears This piece drops off into the mould and is pressed into shape.

ANNEALING

When the mould is cool enough to handle, the glass "blank" is immersed in a liquid which has the same refractive index as glass. In effect, this make the glass invisible and any imperfection inside the glass can be clearly seen when the container is illuminated.

During solidification of the glass in the moulds, certain internal strains and stresses are set up. These would seriously affect the optical properties of th glass and must be removed. This is don by annealing and is the most critica stage in the manufacture of optical glass

The blankets are sealed in steel containers and placed in a furnace unde carefully controlled conditions. Slow

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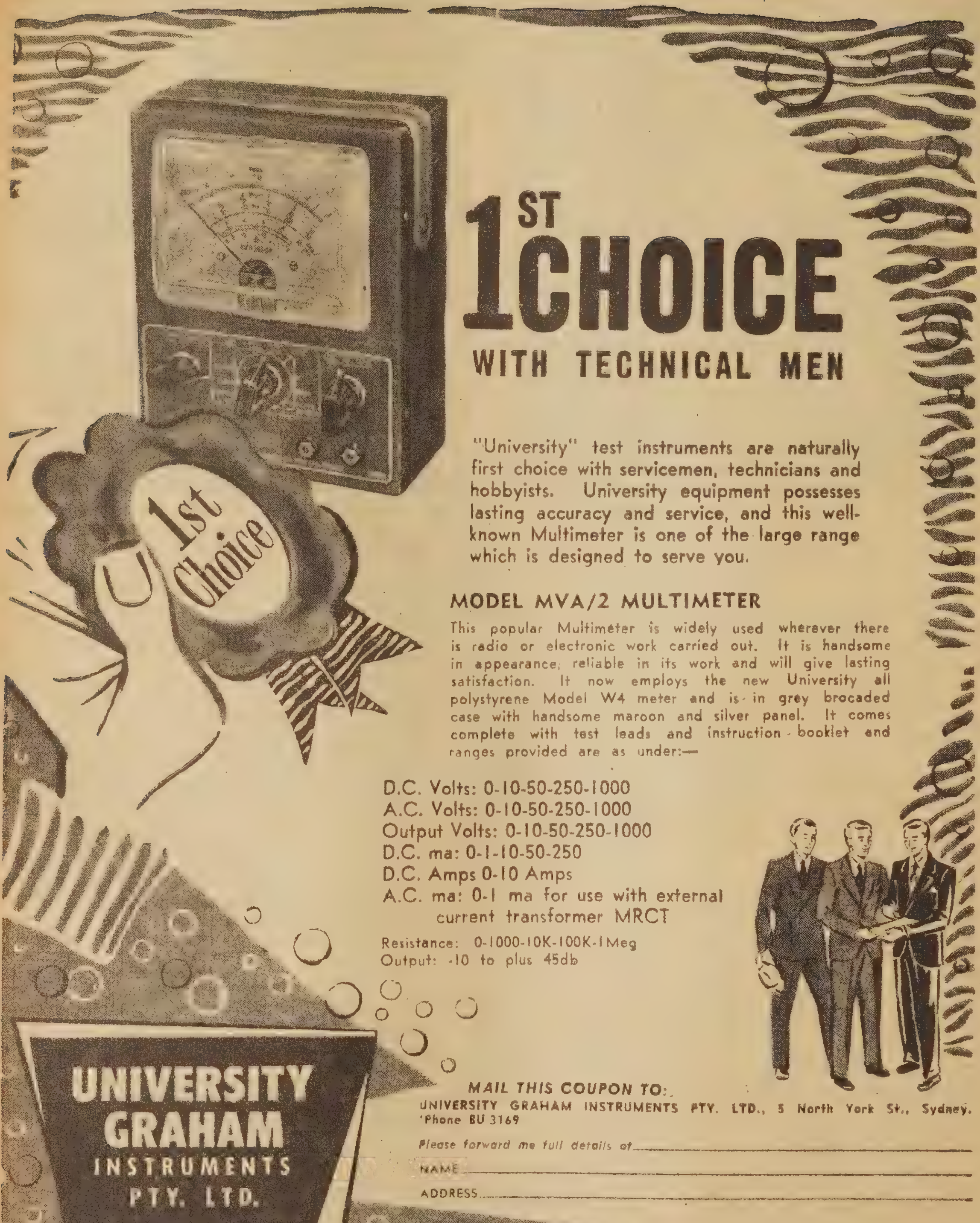

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Technical Review

TRANSISTOR WORKS AT CRYOGENIC TEMPERATURES

Where ordinary transistors fail because of immobilisation of charge carriers at temperatures in the liquid-helium range, a grain-boundary transistor operates successfully. Device is fabricated from a bicrystal formed by two crystal-lattice structures of different grain orientation. Modulation of sheet conductance at boundary yields amplification.

NOW in the laboratory stage of development, a new type of transistor has the capability of operation at cryogenic temperatures as low as 2 deg K. Such a transistor would have applications in space electronics where low temperatures could immobilise the carriers in conventional semiconductor devices.

Scientists at Sylvania Electric Products Research Laboratories in Bayside, N.Y., call the device a grain-boundary transistor because it uses the properties exhibited by the boundary formed between the crystal lattice structures of different grain orientation to form structures similar to npn or pnp junctions.

If two seed crystals are tilted symmetrically about an axis in the 001 direction, as shown in Fig. 1, a bicrystal ingot can be grown naturally in which the two portions of the bulk material have lattice structures oriented at the third angle. The transistor is fabricated from slices cut from the ingot perpendicular to the growth direction. If the bulk material used in n-type germanium, the grain boundary exhibits p-type characteristics. Similarly, if n-type silicon is used in the bicrystal, the grain boundary is p-type.

Analysis of the properties of the grain-boundary region indicates that a sheet of negative charges due to electrons captured in boundary states is formed within the crystal. The negative charges along the boundary are compensated by a positive space charge composed of ionised donours (in n-type germanium). Hence the potential change across the boundary is similar to that of an npn structure.

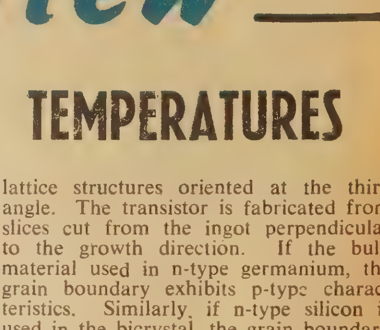


Fig. 2—Simplified circuit shows how modulation is applied to transistor.

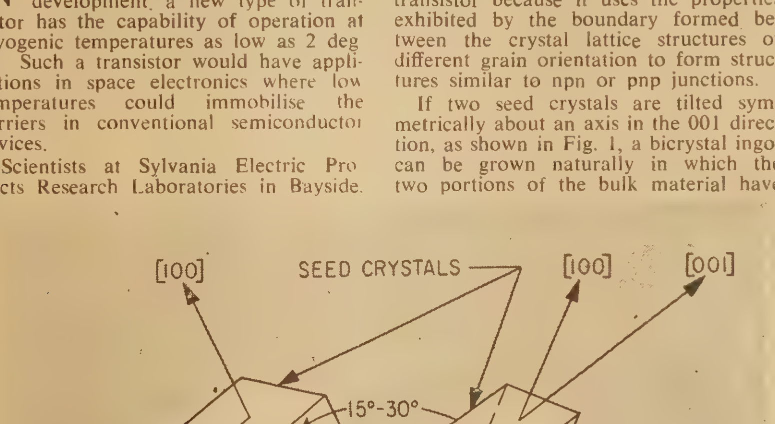


Fig. 1—Diagram shows how crystal is grown from precisely oriented seed crystals. Water is cut perpendicular to growth direction.

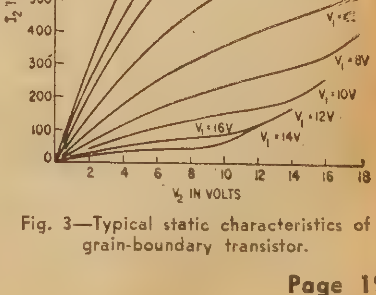
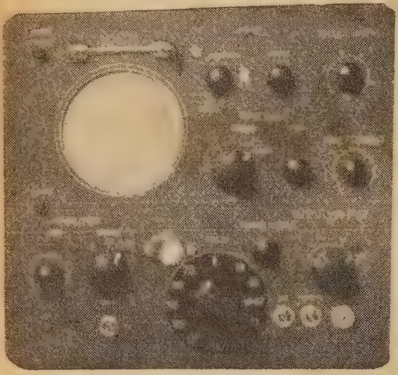


Fig. 3—Typical static characteristics of grain-boundary transistor.

TV SERVICING! — ALIGNMENT



DO *YOU* HAVE A PROBLEM?

We are proud to announce the release of the Klaus Heucke Model WO512B sweep and marker generator with oscilloscope.

★ A new type of instrument combining TV sweep and marker facilities and inbuilt display unit.

★ Oscilloscope may be used separately.

★ An entirely new type of instrument which will be of particular interest to service organisations and manufacturers.

PRICE: £279/-/- FOB/FOR Sydney (Plus Sales Tax)

FREIGHT COSTS EXTRA INTERSTATE

The WO512B introduces a TV service instrument into Australia which is entirely new in this field. The great advantage of the instrument lies in the inclusion of the cathode ray display unit WITHIN the instrument, eliminating the need for numerous external connections and the resultant errors arising from their use. Special note should be taken of the turret switching, ensuring rapid alignment, and the fact that the oscilloscope may be used as a separate service unit in the usual manner with a bandwidth of 4Mc/s.

SPECIFICATION

1. SWEEP GENERATOR

Mid frequencies: (Turret Switch)

Channel 1.	= 8 Mc/s.	Channel 7.	= 143 Mc/s.
2.	= 33 Mc/s.	8.	= 178 Mc/s.
3.	= 53 Mc/s	9.	= 185 Mc/s.
4.	= 67 Mc/s.	10.	= 192 Mc/s.
5.	= 89 Mc/s.	11.	= 199 Mc/s.
6.	= 136 Mc/s.	12.	= 213 Mc/s.

Fine control of Mid Frequency:	0 to ± 6 Mc/s, continuously adjustable and readable.
Sweep Deviation:	± 50 Kc/s to ± 10 Mc/s, continuously adjustable and readable.
Sweep Frequency:	50 cps sawtooth, zero line retrace.
Output voltage:	< 30 uv—approx. 250 mv for Channels 1, 3-12. < 30 uv —approx. 100 mv for Channel 2. continuously adjustable.
Frequency accuracy:	± 1 Mc/s.
Frequency stability:	± 0.5 Mc/s.
Frequency linearity for 20 Mc/s deviation:	< ± 10% at < 100mV output voltage.
Amplitude variation at 20 Mc/s deviation:	< 10% at < 100mV output voltage.
Output Impedance:	60 ohms, unbalanced.

2. OSCILLOSCOPE WITH AMPLIFIER

Time Base: Sweep Frequency:	20 cps—100 kc/s or external Time Base.
Time Base: Coarse control	1 : 8 per step.
Vernier Control	1 : 10 continuous.
Amplifier:	
Max. sensitivity	50 mV p-p/cm.
Input capacitance	25 pf.
Input impedance	3 megohms.
Attenuation range	1 : 1,000.
Bandwidth	5 cps to 4 Mc/s (- 3 db). useable to 8 Mc/s.
Input attenuator:	
Coarse control	1 : 10 and 1 : 100.
Vernier control	1 : 10.

3. MARKER GENERATOR.

Frequency accuracy:	± 250 kc/s.
Separation accuracy of lateral markers	± 10 -4.

4. Tube complement:	
1 x DG 10/6 (CRT)	3 x EF 80.
1 x E 88 CC	1 Stabiliser 150 C1.
2 x ECC 81	5 Germanium Diodes.
2 x ECH 81	1 x ECL 80.
5. Power Supply.	110/125/220/235 volts. 50 cps.
6. Power consumption.	50 VA.
7. Dimensions.	10,7 x 11.5 x 13.5 inches.
8. Weight.	36.4 lbs.

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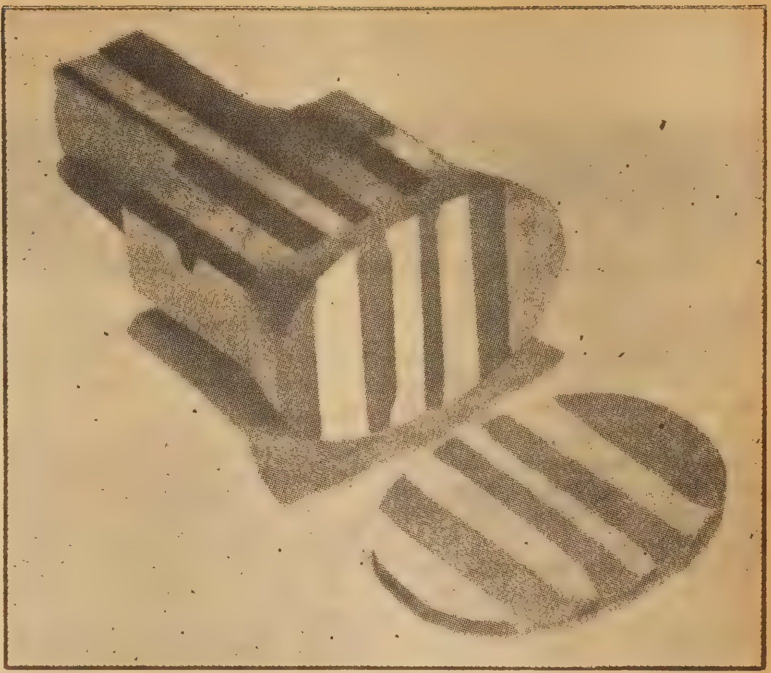
AND DISTRIBUTORS THROUGHOUT AUSTRALIA

Experimental germanium grain-boundary transistor. Ridge along centre of wafer is one of a pair of rectifying contacts.



Germanium ingot and slice showing multiple grain boundaries grown on the same ingot. Similar structures can be grown with silicon.

BOUNDARY CHARACTERISTICS

The grain boundary exhibits two important characteristics; namely the independence of the grain boundary sheet conductance with respect to impurity concentration and the consequent temperature independence of the sheet conductance.

Figure 2 shows how the wafer is connected as a transistor and Fig. 3 shows typical characteristic curves obtained. Modulation of the sheet current can be obtained by changing the depletion layer width with an applied field, producing amplification.

PHOTOVOLTAIC EFFECT

Another interesting characteristic of the grain boundary is a photovoltaic effect in which the photovoltage produced by a small light beam symmetrically distributed across the boundary experiences a reversal in polarity which goes through zero.

The curve shown in Fig. 4 is a plot of the photovoltage as a function of the distance of the light beam from the boundary. The distance between peaks corresponds to the width of the beam, in this case about 10 microns. This property may have applications as a means of precisely locating the position of a spot of light, such as in missile homing devices. The resolution is limited only by the width of the negatively charged sheet at the grain boundary.

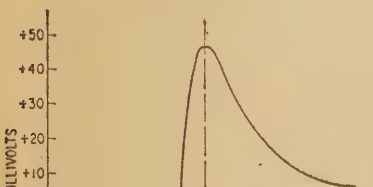


Fig. 4—Distance between peaks of photo-voltage characteristics corresponds to width of light beam crossing boundary.

Optimum impedance and frequency considerations have yet to be determined, but Sylvania scientists express confidence that progress is merely a question of developing the technology. Transistors with transconductances of 3,000 umhos have been made in the laboratory, and a method of growing a multiplicity of boundaries on one ingot has been developed, thus facilitating production.

(—Electronics).

NEW VALVES ARE OF THIMBLE SIZE

(Continued from Page 11)

variety of industrial applications.

"Preliminary tests indicate that Nuvistors should better meet the very critical military reliability and environmental objectives than larger, traditional-design tubes. The materials used will maintain the excellent resistance of the electron valve to damage from nuclear radiation.

Explaining Nuvistor's unique construction, Mr Smith said:

"For ruggedness, we start with a strong ceramic base-wafer as a platform and erect an array of valve electrode assemblies on it. Each assembly is held rigidly in place by a tripod-like structure. Nuvistors are made of ceramic materials and strong metals such as steel, molybdenum and tungsten.

"The electrodes are strongly supported from one end in a cantilever fashion, a method employed for bridge-building in which trusses are extended from piers. This construction feature eliminates the need for mica support discs or spacers. All the electrodes are small, light cylinders. They are able to withstand a high degree of shock or vibration because of their shape and low mass."

The following advantages of the Nuvistor construction are cited: (1) cylindrical symmetry and cantilever construction permit the use of accurate jigs for assembly; (2) brazing of assembly in accurate jigs produces a strain-free structure; (3) micas are completely eliminated; (4) high-temperature processing results in super-clean structure; (5) indexing lugs permit safe and easy insertion into tube socket; (6) valves can operate in high temperatures; and (7) they use no glass which might shatter under mechanical or thermal shock.

DESIGN PERMITS HIGH-SPEED MECHANISED ASSEMBLY

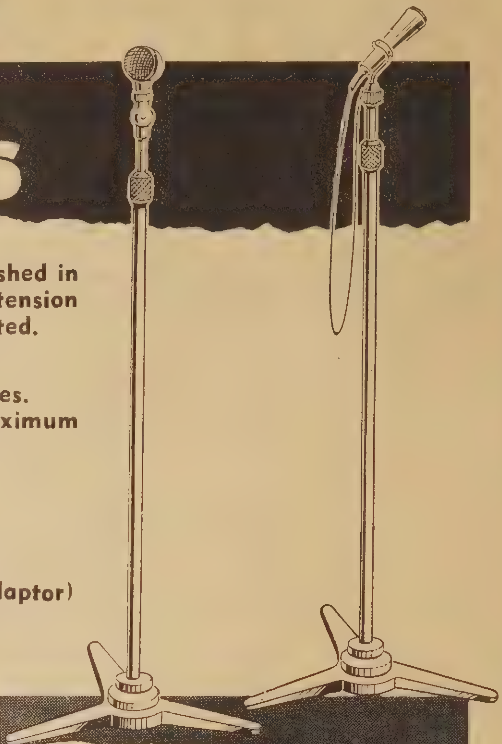
The simplicity of design and the cylindrical symmetry permit a high degree of mechanised assembly. This design makes possible close-spaced electrode assembly with accuracy and uniformity built into both the jigs and the parts.

The high degree of control obtained permits accurate spacing of the elements with increased assurance against interelectrode shorting. Improved uniformity of electrical characteristics also results from this high degree of control.

FUTURE OF NUVISTOR TUBE DESIGN

Development of the Nuvistor design concept leads the way to further reductions in size and power requirements and to improved reliability and performance characteristics. Because of the many new techniques already uncovered a complete line of tubes including damper tubes, vertical-deflection tubes high and low-voltage rectifier tubes seem assured. The "new-look" design clearly confirms that the electron valve has not yet approached its theoretical limitations acos

microphone FLOOR STANDS



Two new Floor type Microphone Stands are now available for use with Acos Microphones—

Model "A" for use with type MIC 16 Microphone. The top of the extension arm is threaded to take MIC 16 Microphone.

Model "B" for use with MIC 39. The extension arm has a special adaptor to take the MIC 39 Microphone. The base and lower tube are finished in silver varitone, the extension arm being chrome plated.

Dimensions:—

Base diameter: 17 inches.

Height: Min. 3' 3" maximum 5' 6".

Weight: 11 pounds.

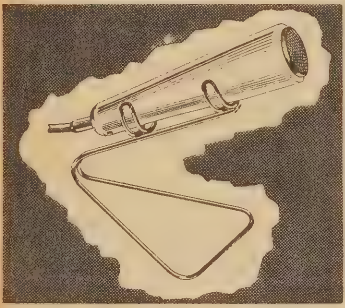
Prices:—

Model "A" £5/6/-.

Model "B" £7/-/-.

(includes MIC 39 adaptor)

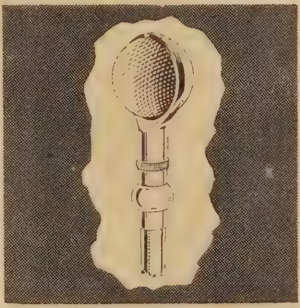
COMPANION MICROPHONES



CRYSTAL STICK MICROPHONE, MIC 39-1

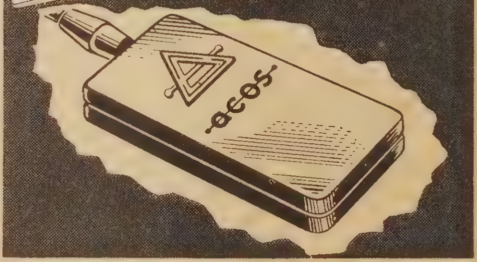
The MIC 39-1 has been beautifully styled as a hand, desk stand or floor stand unit, and precision engineered to the highest professional standards. A heavy die-cast liner in the microphone case eliminates the possibility of hum pick-up due to hand capacity effects. The use of a special noise-free cable improves screening and gives a greaty increased signal-to-a-noise ratio.

Designed especially for high quality recording, broadcasting and public address work. PRICE £8/19/6, complete with desk stand.



HIGH-QUALITY MICROPHONE, MIC 16.

Incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock, and the fidelity is not impaired by low-frequency noise. This microphone has been designed to satisfy the most exacting requirements of Acoustic measurements, Industrial noise measurement, Disc Recording technique, and Public Address systems, etc. PRICE £24/19/6.



STRINGED INSTRUMENT AMPLIFIER, TYPE VP 1.

The VP I Vibro-Voice has been specially designed for use with guitars, double bass and in fact all stringed instruments. With the use of this simple yet effective pick-up together with a good quality amplifier any instrument can be amplified.

The VP I has an ample output and a frequency range which extends to approx. 5 K/cs. The tough rubber case protects the instruments from damage. Easily connected to the PU input of your amplifier or radio with a resistance of 5 megohms in series with the inner core of the cable: PRICE £7/15/-:

Technical data gladly forwarded

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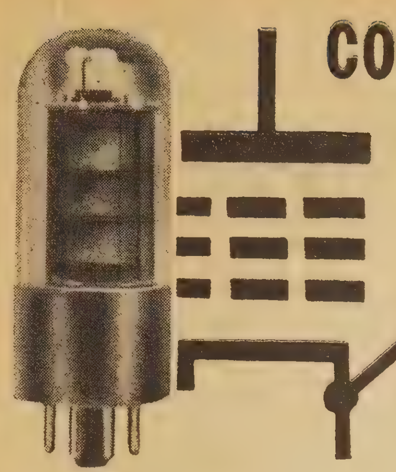


COLD-CATHODE— Revolutionary New Heaterless Tube

Engineers are still working on new valve ideas, despite the onwards march of the transistor. This new development of a practical cold cathode could well have far-reaching results.

THE U.S. Signal Corps and Tung-Sol Electric recently unveiled, at a special demonstration, a new tube said to be "the first major break-through in tube design in more than 30 years."

Outwardly, the tube that was demonstrated is conventional in appearance—for the very good reason that it was constructed in an existing tube envelope. Its internal construction (see Fig. 1) is less conventional, but old-timers will recognise the space-charge circuit that enjoyed a slight popularity for a time in the '30s, using tetrodes such as the type 49.

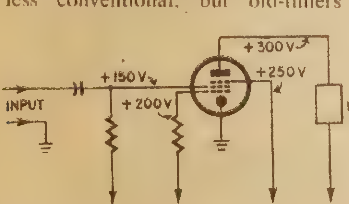


Fig. 1—Internal construction and basic circuit.

It is the cold cathode that makes this tube a "major break-through."

Almost since the triode was invented, people have wished for a tube that would not waste power heating the cathode.

Dr Dietrich Dobischek, of the Signal Corps, discovered in 1952 the effect that was to lead to such a cathode. He was bombarding a thin layer of magnesium oxide with an electron beam, to produce secondary emission. The emission was enhanced by maintaining a high positive field near the surface of the layer.

Dr Dobischek was startled to find that the emission continued after the bombarding beam was turned off. The magnesium oxide was emitting electrons on its own, under the influence of the positive field near its surface.

Experiments were immediately begun to see if the newly discovered phenomenon could be adapted to use in electronic tubes. Cathodes were made of various magnesium compounds (some good ones were actually made of drug-store milk of magnesia) and improved methods of preparing and applying the oxide to the nickel sleeve that supports the cathode layer were developed.

Tung-Sol scientists concentrated particularly on methods of making cathodes that could be adapted to mass production. The end result was a sprayed-on coating of porous pure magnesium oxide.

When bombarded by electrons to produce secondary emission, the surface of this layer becomes highly positive. It is suspected that this high electric charge draws electrons from the interior of the thin layer and that an avalanche effect similar to that in some semi-conductor devices is produced.

BLUE GLOW.

A characteristic blue glow develops and—with the help of the external field supplied in the new tube by the first grid—the emission continues till the external circuit is broken.

This brings us to the greatest disadvantage of the new tube—the emission is not self-starting. The disadvantage is not too serious—very little is required to start the tube working. In the tube demonstrated, part of the B-supply power was used to light (for less than a second) a tiny filament so placed that light and electrons emitted from it would strike the cathode. Other proposed methods include mixing a little radioactive substance with the cathode material, which would make it self-starting. Or a photo-emissive ma terial could be used, which would caus ordinary light to start the action.

Once the tube has been started, could be maintained by a keep-aliv circuit in many types of equipment. Th emissive action continues down to les than .01uA per sq. cm. A resistor i the order of megohms around the on-o switch would keep the tube at standb

Another disadvantage cited again the tube is the high voltage—300 to 50 —required to operate it. This voltag has already been reduced in some tube and it is believed that tubes will be bui to use no more than 180 volts.

The great advantage is, of cours the power economy. In many receive and industrial electronic application the heater consumes practically all th power used by the tube. Its almo instant starting is an important featu in many applications.

And the cathode has an infinite lif some cathodes having already run 14.0 hours with no signs of deterioration. T service technician will also note the in possibility of a cathode-heater short.

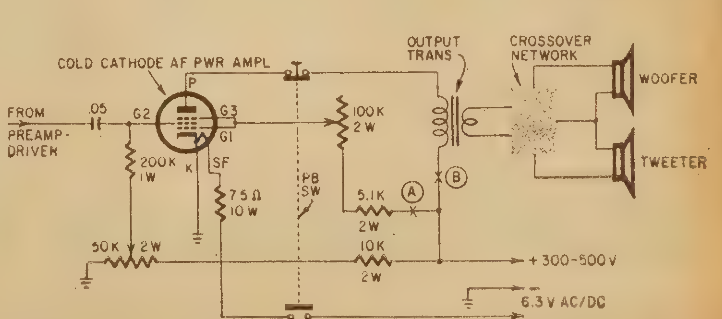
SOON AVAILABLE

The only type so far construct is a power amplifier tube. An amplifi (Fig. 2) using one of these sounde exactly like what would be expect from similar equipment using h cathode tubes. The tube was also use to operate relays at the Signal Corp Tung-Sol demonstration. It flashed ligh or closed relays in milliseconds, from cold start.

Tung-Sol plans to put the new ty on the market as soon as a comple line of tubes is worked out. Work also under way on a cold-cathode ele tron gun for cathode-ray tubes (som thing which should bring true portab televisers even closer).

But the future of the new catho material does not stop there. Accordi to Dr A. M. Skellet, Tung-Sol direct of research, the material may ma possible a flat picture-on-the-wall d play device for TV or radar. It m also lead to great advances in amplifi tubes employing secondary emissi multiplication. It may have applicatio even in the field of lighting, produci a lamp similar in appearance to prese fluorescent types, but with great brightness and longer life. It wou work as well at 50 degrees below ze as in the 100 degrees-plus of the tropi

—Radio Electronics



(A) Meter may be inserted to measure emission sustaining current.
(B) Meter may be inserted to measure plate current.
G1 Emission sustaining grid.

G2 Control grid
G3 Screen grid.
SF Starter filament.
K Cathode
P Plate.

Fig. 2—Typical circuit for cold-cathode audio power amplifier. Double-pole mentary switch is pressed to start cathode emission.

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P154

NEWS AND VIEWS OF THE MONTH

Discoverer II

DISCOVERER II joins in space earlier vehicles still aloft (the American Explorers I and IV and Vanguard I and II, and Russia's giant Sputnik III.)

The Discoverer, carrying a special capsule within its 440lb payload, was launched successfully from Vandenberg Air Force base, California.

But at Cape Canaveral, Florida, a three-stage Vanguard rocket failed soon after take-off.

It fell back into the ocean, taking with it the two "would-be" satellites.

The 195lb capsule within the Discoverer payload carries cameras to record the density of cosmic radiation deep in space.

An ejection device, activated by radio, is designed to set the capsule free and allow it to descend to earth by parachute.

The National Aeronautics and Space Administration, which conducted both satellite attempts, hopes to retrieve the capsule over Hawaii.

U.S. Air Force planes trailing drag equipment will try to grab the capsule in midair.

The Air Force announced in Washington that tracking data indicated the satellite's orbit went as far as 243 miles from the earth and as close as 156 miles.

The satellite was whirling around the earth in a nearly north-south orbit every 90.84 minutes at 17,433.8 miles an hour.

It could remain in orbit for up to a month.

Seeing with Sound

A CAMERA which can see inside engineering components and the human body was described in London recently.

The camera also can see under water. It works with sound waves.

The instrument could become of great use to engineering and possibly to medicine.

Dr C. N. Smyth and Mr J. F. Sayers explained how sound waves could be focused with lenses, and how images of objects exposed to noise could be formed and reproduced at a distance.

The camera has a sound-sensitive, image-receiving surface.

This is a bare slice of crystalline quartz, which, under the impact of sound, develops on each point of its surface a voltage proportional to the ultrasound intensity.

The value of this voltage is detected, point by point, by a scanning electron beam.

After amplification it produces a visible image of the internal structure under examination.

Jap. Drive on Transistors

THE clever fingers of young Japanese women are leading the country to a large share of the world electronics market.

The manual skill of the Japanese people is being combined with modern scientific and engineering techniques, to provide a unique advantage in manufactring the tiny transistor, a key factor in small-sized electronic equipment.

In the mushrooming local factories, Japanese girls demonstrate their aptitude for such work as enclosing the sensitive germanium semi-conductor in a glass, metal or plastic shell.

In workrooms looking like High school laboratories, rows of female workers in their white uniforms seal the transistors with gloved fingers inside airtight light boxes.

Many of the young girls would be attending High schools, if they could pay their way.

Instead, they are working at an average wage of £8 a month, after a training of two years.

"You cannot apply mass production conveyors or automation methods to th production of transistors," a factory manager said.

"This is our strong point in competin with manufacturers in other countrie with high industrial development, bu with high labour costs."

He predicted that Japan would, befor long, monopolise all the transistor mar kets, and consequently small radio se markets, in the world, thanks to th cheap, deft-fingered little workers.

Britain's Flying Sauce

BRITAIN'S fantastic "sea saucer," th forerunner of giant flying ship which will revolutionise ocean travel b skimming at high speed a few feet abov the waves, is nearly ready for flight.

The prototype, a gleaming 25ft ova of polished aluminium, will have its fir hovering tests next month.

If all goes well it will be launched o Southampton Water early in June, a cording to the "Daily Mail."

Work on the "sea saucer" has bee going on for the past year at Cowes, Is of Wight.

The giant flying-ship—officially calle a Hovercraft—is being developed b Saunders Roe, under a contract from new firm set up to exploit the inve tion.

The firm, Hovercraft Developme Company Limited, and Saunders Roe a being backed by the National Researc Development Corporation.

The first trials will be made with t Hovercraft tethered to a giant gantry the Saunders Roe works, said the "Mail

The machine is expected to raise seven and a half tons weight 15 to inches out of the water on a ring of jets.

As the pilot deflects the direction the jets it will skim over the water speeds of up to 50 m.p.h.

An 850 h.p. Alvis Leonides ae engine drives fans which draw through an intake on the top of machine.

The air is blown out through a co tinuous slit running around the bottom

One of the first uses of the Hovercr might be as a car ferry.

This would mean a much bigg machine with a flat deck.

To Stop Scribblers

P.M.G. officials hope mirrors will st people doodling on the walls telephone boxes.

They have lined the interior of seve telephone boxes with mirrors in the ho it will frustrate the scribblers.

The "new look" phone boxes are be tried in Brisbane and the Queensla Gold Coast.

Post Office officials will consider results of the trial within the next f weeks.

So far, postal officials have used ma tricks to stop the doodlers.

Now they think the doodlers—esp aly the women—will be so busy look at themselves they won't have time scribble.

Dialling a telephone number may soon be old fashioned in the U.S. . . . instead you'll simply press buttons! Apart from being faster than dialling the new system will result in fewer wrong numbers, the telephone companies say. The new-style telephone —pictured here—is being tried out in a number of towns and cities across the country.

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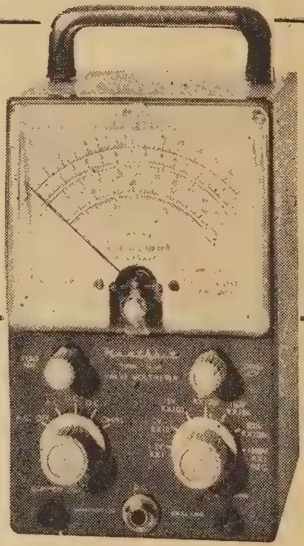

- **Large Easy-To-Read 4½in 200UA Meter**
- **1% Precision Resistors for High Accuracy**
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MEASUREMENTS: This multi-function VTVM will measure AC voltage (RMS), or AC voltage (peak-to-peak), DC voltage nd resistance. There are seven AC (RMS) and DC voltage ranges of 0-1.5, 5, 15, 150, 500 and 1500. In addition, there are even peak-to-peak AC ranges of 0-4, 14, 40, 140, 400, 1400 and 4000. Seven ohm meter ranges provide multiplying factors of 1, X10, X100, X1,000, X10k, X100k and X1 megohm. Measures .1 ohm to 1,000 megohms. A9 zero-centre scale db range also provided.

Sepaarte AC to DC test leads and probes are provided for circuit efficiency and a polarity reversing switch is employed or DC operation, making it unnecessary to reverse the test leads.

SIMPLE INSTRUCTIONS TELL YOU ALL YOU NEED TO KNOW — GUARANTEE SUCCESS

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verything you need to know is contained in this clearly ritten text. It has been especially designed to take you rouhg every phase of assembly with ease, even though you ay be a complete newcomer to electronics.

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structions begin at the very beginning, and even illustrate d describe the proper procedure for making good solder nnections. You can't go wrong if you follow the directions.

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ead the step . . .perform the operation . . .and check it off . . it's just that simple! These plainly worded, easy-to-follow eps cover every assembly operation, and let you rely on our perience in kit construction.

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Defence Against Gas

A "BLACK light eye" which will detect evaporation from one droplet of liquid the size of a pinhead has been developed by Army chemists, according to reports from Washington.

It is designed for use of troops in the field against chemical attacks.

The new device, known as "lopair" (long path infra-red), will flash a warning light and sound a horn when a tiny amount of contamination in the air crosses a beam of "invisible" infra-red light.

It will detect contamination even when it is colourless and invisible to the human eye, as in the case with most potential toxic warfare agents.

In combat, it would warn soldiers in time to put on their protective masks.

The current model consists of two separate parts.

One unit, mounted on a tripod, contains the source of the infra-red light, a mirror which directs the beam, and a detector to analyse the beam when it returns to its source.

The other unit, which also can be mounted on a tripod, is a specially designed, self-aligning miror which is placed at the other end of the beam's path and reflects the beam back to the detector.

Both units weigh a little more than 50lb. Each can be carried easily by one man.

The complete alarm system can be set in operation in les than five minutes. Power is supplied by storage batteries.

The system, according to the Army chemists, can detect and measure almost any substance by its characteristic infrared spectrum.

Once the alarm has been properly set to detect a particular substance, however, it normally will not be set off by other materials likely to be present.

Hope for Bad Hearts

TECHNIQUES for analysing radio signals from missiles are being used to detect hardening of the arteries.

The American Heart Research Foundation said this in Los Angeles.

It said the techniques even might lead to a cure of the disease—arteriosclerosis.

The disease was the most frequent cause of death in the United States today.

It caused strokes, heart attacks and kidney failure.

Foundation director Dr Travis Winsor said the type of magnetic tape used at missile tracking stations recorded heartbeat pulsations and blood vessels' vibrations.

Analysis through a procedure devised by Lockheed Aircraft Corporation engineers permitted diagnosis to a degree impossible with other equipment.

The engineers work at the Lockheed missiles and space division.

Dr Winsor said the new technique worked in this way:

- Plastic cuffs on a patient's wrists and ankles picked up varying pressures in blood vessels.
- The variations were recorded on the tape, then converted into lines on graphs.
- Electronic computers analysed the pressure changes much faster and more accurately than a technician could.

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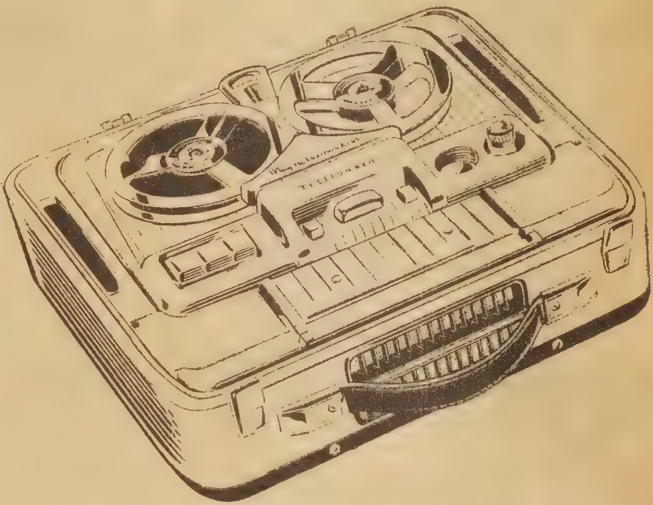
The Telefunken tape recorder, Magnetophon KL65X, is a first-class recording and playback instrument suited for music as well as speech.



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- Footage counter.
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- Push-button control.
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- Frequency response:—
  1⅞ ips . . . 60-8,000 cps.
  3¾ ips . . 60-13,000 cps.
- Lightweight—20 lbs.
  Size: 15in x 13⅜in x 6¼in.

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Type	D.C.mA	Primary Volts	Sec. Volts per Side	Filaments
PT1880	60	0-230-240	250	6.3V-1A Tap at 5V-2A; 6.3V-2A
PT1881	60	" " "	285	6.3V-1A Tap at 5V-2A; 6.3V-2A
PT1882	60	" " "	325	6.3V-1A Tap at 5V-2A; 6.3V-2A
PT1883	60	" " "	385	5V-2A; 6.3V-2A.
PT1884	80	" " "	250	6.3V-1A Tap at 5V-2A; 6.3V-2A; 6.3V-CT-2A.
PT1885	80	" " "	285	6.3V-1A Tap at 5V-2A; 6.3V-2A; 6.3V-CT-2A.
PT1886	80	" " "	300	6.3V-1A Tap at 5V-2A. 6.3V-CT-2A; 6.3V-CT-2A
PT1887	80	" " "	325	6.3V-1A Tap at 5V-2A, 6.3V-2A; 6.3V-CT-2A.
PT1888	80	" " "	385	5V-2A; 6.3V-2A; 6.3V-CT-2A
PT1889	100	" " "	285	6.3V-1A Tap at 5V-2A; 6.3V-2A; 6.3V-CT-2A
PT1890	100	" " "	300	6.3V-1A Tap at 5V-2A. 6.3V-CT-2A
PT1891	100	" " "	325	6.3V-1A Tap at 5V-2A; 6.3V-2A 6.3V-CT-2A
PT1892	100	" " "	385	5V-2A; 6.3V-2A; 6.3V-CT-2A
PT1893	125	" " "	285	6.3V-1A Tap at 5V-2A; 6.3V-2A; 6.3V-CT-2A
PT1894	125	" " "	300	6.3V-1A Tap at 5V-2A; 6.3V-CT-2A 6.3V-CT-2A
PT1895	125	" " "	325	6.3V-1A Tap at 5V-2A; 6.3V-2A; 6.3V-CT-2A

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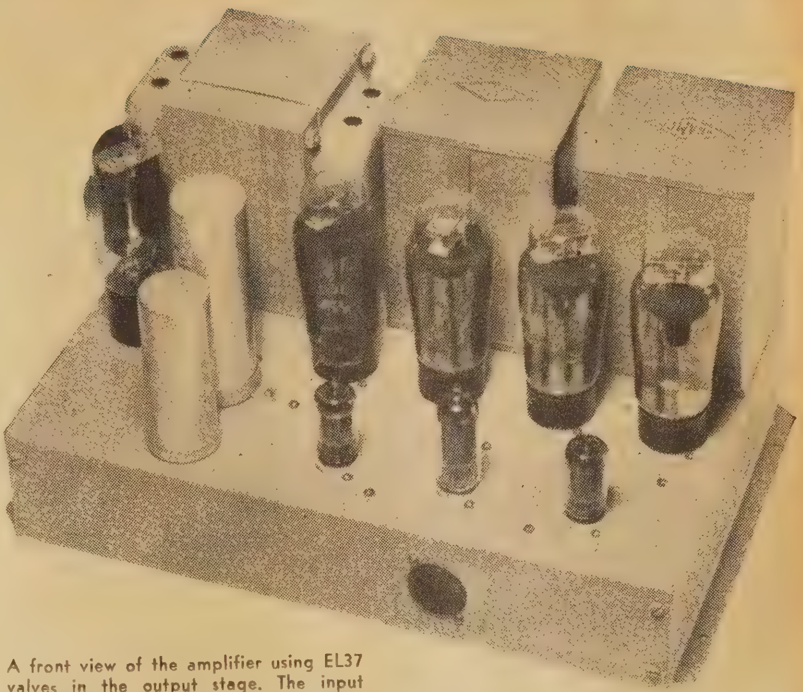
High Powered Stereo Amplifier Design

by *John Moyle*

Not only is this amplifier a tested and practical unit as it stands, but it can be used unaltered with several types of standard output vaves. With higher voltages, and modifications to output load if necessary, outputs of up to 35 watts can be obtained for special cases. However, few people will ever need more than the nominal 17 watts per channel which it can provide using standard components.



A front view of the amplifier using EL37 valves in the output stage. The input socket is seen at the side of the chassis.

THE amplifier detailed here is actually a higher powered version of the 10-watt stereo amplifier described in the magazine in the January issue.

It bears the same relationship to the original amplifier as did the 17-watt Playmaster to the smaller versions, and it is, in fact, made up of two 17-watt units combined on a single chassis.

From every point of view, the 10-watt stereo amplifier has proved to be completely successful. Built with the best components, its performance is not likely to be bettered by anything else you could use, as the test details given at the time made clear, and constant use has verified.

STANDARD LAYOUT

The layout was developed with special emphasis on balance, short leads and ease of construction. At the time we had it in mind to use this as a standard type of layout which could be adapted to various amplifier sizes and valve types, it merely being consistent to follow it in the present case.

There isn't a great deal of profit at the moment to discuss the merits and demerits of such high power applied to stereo, remembering that when both channels are running at full load the undistorted output is something like 40 watts.

But there isn't a shadow of a doubt that, whether we were to publish this design or not, many readers would ask us for just this thing, and in many cases they will probably use it.

Our experience is that, coupled to good speaker systems, this amount of power is enough to fully load a good-sized hall, but, as the extra cost isn't very much greater than that of its junior relation, one might make a good case for having a reserve for special occasions.

VALVE TYPES

Another virtue of the circuit is that, without any alterations, one can use 6L6's, KT66's, EL34's and even 807's. The EL34's will give about the same output as the EL37's and about 12-14 watts per channel would be a probable figure for the same operating voltages with 6L6, KT66 and 807's.

But there could be plenty of people with these valve types and a couple of good output transformers on hand, and no reason why they should not be used for economy sake alone.

And there would be no need to change any component values or output transformer specifications.

To operate large valves well within ratings is good practice for reliability and long life.

The EL37's have a big advantage in that they will give about 17 watts per pair with only 250 applied volts.

If you are able to arrange to accommodate and filter a higher voltage supply there is no reason why the same layout should not be used to produce a twin 35-watt job if you so desire, although frankly we would consider such a course as being applicable only to large hall installations.

But providing the necessary modifications to such things as output valve bias resistors, and voltage ratings of components, were carried out, it would be a perfectly practicable scheme, although the power transformer is hardly likely to be a standard item!

In our case we are fortunate in that a standard type TV transformer which has a rating of about 290 volts per side at about 275 mills will be just about right for the amplifier and its control unit.

If you used a tuner in addition you would be wise to do some adding up on current drain to make sure you would not be adding the straw on the camel's back, as there isn't very much to spare for extra loads of this nature.

In actual figures, the amplifiers will draw about 270 mills between them with no signal, rising to about 290 mills on peaks. Experience has shown that, with the 5AS4 rectifier 285 volts at 275 mills can be expected from the power transformer at the output of the filter.

POWER TRANSFORMERS

As all the advertised brands of TV transformers are conservatively rated, they should be able to cope with this load, but possibly not with the addition of a tuner, the power supply of which will need to be separately provided.

The output of 285 volts should provide about 265 volts effective at the plates of the EL37s, enough to ensure the 17-watt output we have found characteristic of them in ultra-linear connection.

In using the 5AS4 rectifier we are again following TV practice, as this is a very robust valve and likely to give a longer life than the indirectly heated types.

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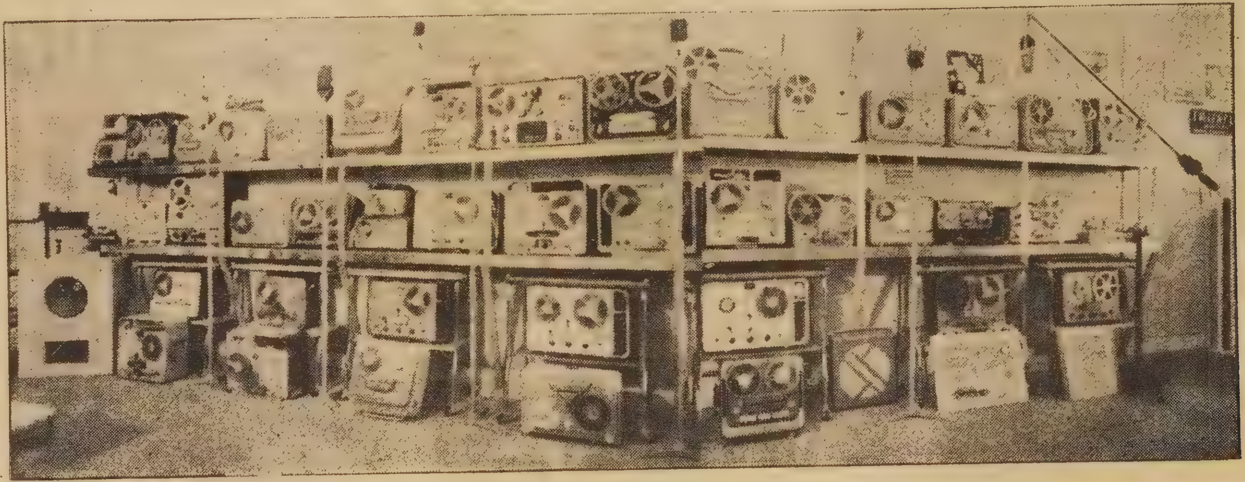

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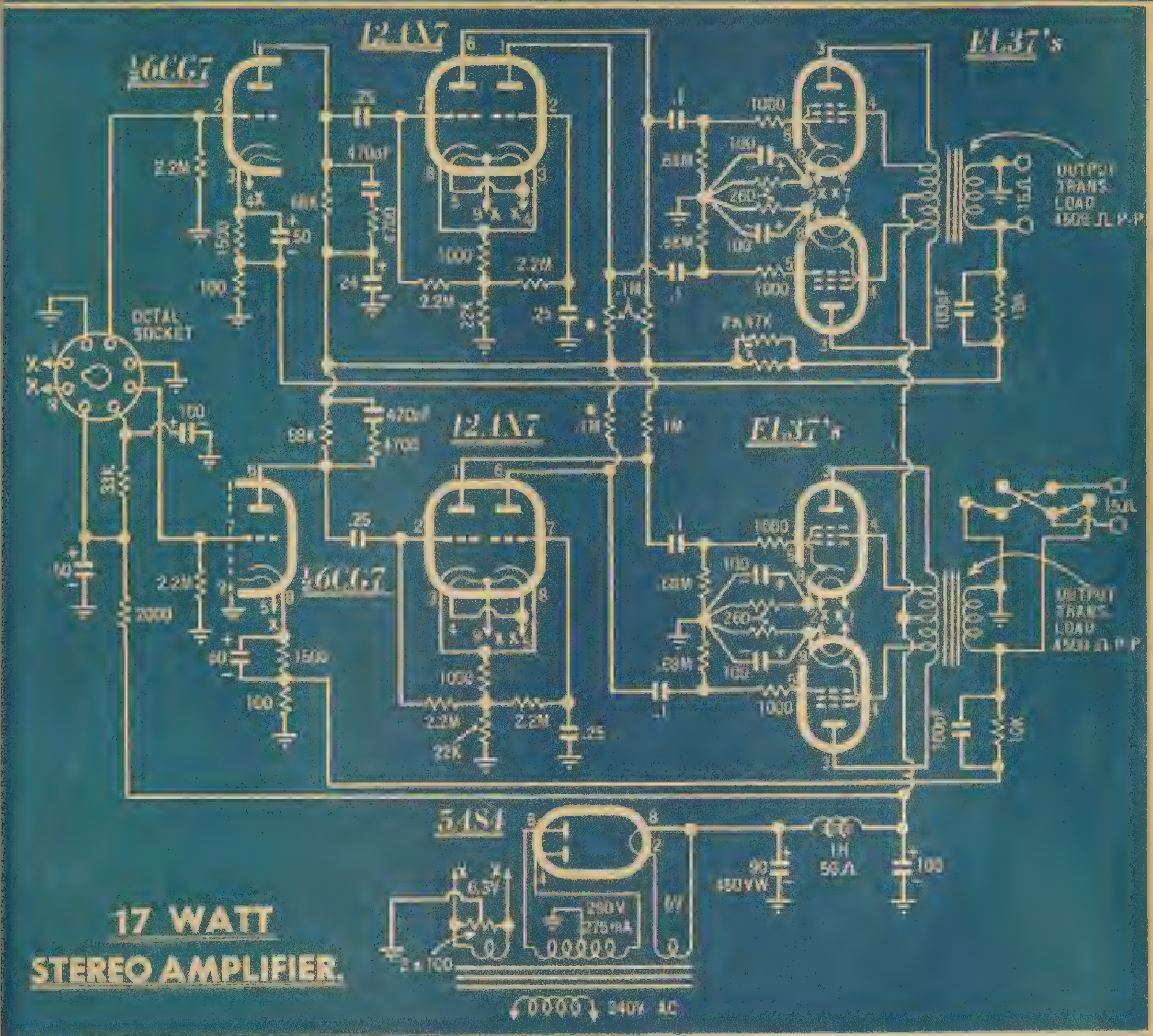


Circuit values are similar to those used for the 17-watt circuit. Exact value of the capacitor across the feedback resistor should be chosen for best square wave response. The feeder componnts for a tuner may be eliminated if one is not or cannot be used. The plate load of each 12AX7 marked with an asterisk should have a slightly greater value than the other.

Concerning filter capacitors, we are again playing safe and specifying a 90 mfd 450 working voltage type at the output of the rectifier. This is a standard capacitor with a peak rating of 450 volts. It is a higher value than for the 10-watt amplifier, but then the current drain is also very much higher. A 50 mfd component would probably be quite all right if the ratings are sufficient as the hum level is really much less than can be regarded as essential.

FILTERING

The second can electrolytic is a double 100 mfd type, one half being used at the output of the filter choke where peak demands are much less, and the other for smoothing the output to the control unit. It virtually guarantees stability with the unit under most adverse conditions, and again lowest possible hum.

The fourth smoothing capacitor is required for the tuner if you should find that the power supply will take the extra drain, or your transformer should have a higher rating than 275 mills. These big transformers are often more lenient to slight theoretical overloads, and we have shown the tuner connection with these things in mind.

This capacitor also forms part of a series type filter for the control unit, and although it might be unnecessary in most cases, we really can't be too careful when feeding high gain control units from the power supply of a big amplifier.

If you find that the single 100 mfd capacitor is good enough for your requirements, you could omit the 50 mfd tubular mounted under the chassis, and also the 2,000 ohm wire wound resistor, the main purpose of which was to carry the higher current of the tuner.

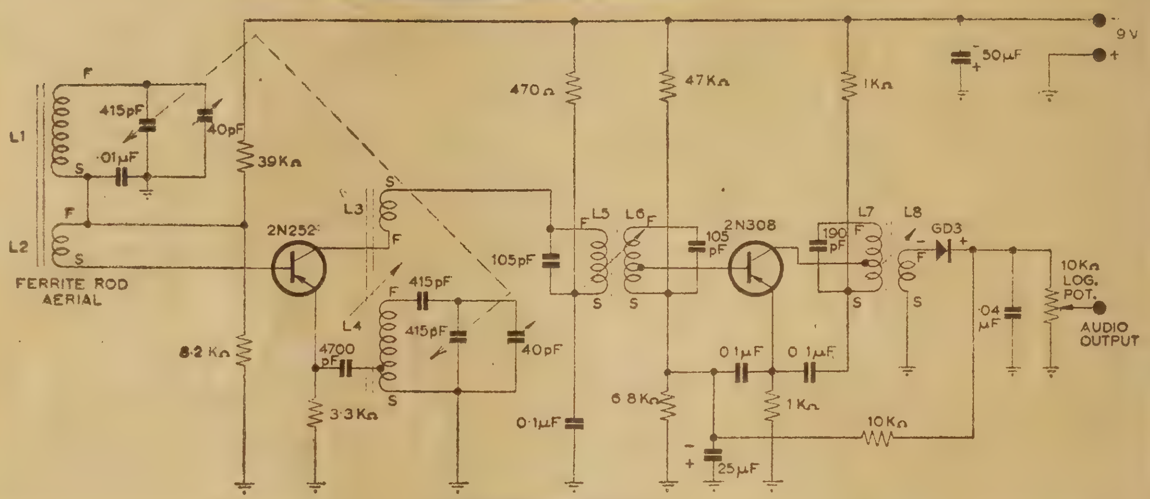
The twin 100 Mfds electrolytics have normally a 350 volts working rating which is quite sufficient in this case.

The bias resistors for the output valves can quite satisfactorily be restricted to two only, one for each pair of valves, but it is, on paper at least, a better scheme to bias them separately in the interests of balance, as was done with the 10-watt circuit. The extra cost is quite small when referred to an amplifier of this quality.

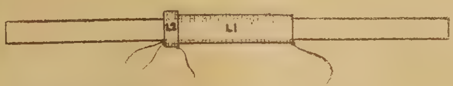
COUPLING CAPACITORS

You will note that we have used .1 mfds coupling capacitors in the grid circuits of the output valves instead of .25 mfds shown in other circuits for the 17-watt amplifier. Looking at the picture as a whole, it seems best to avoid having too many bass roll-offs occurring too low down in the frequency range, particularly when the exact type of output transformer you will use is not known. Extending the bass response to the extremely low frequencies might improve stability in some cases, but endanger it in others. It is a minor point, as it is most unlikely that any trace of low frequency instability will be experienced, and the frequencies concerned are far below those required for any possible program material. **(Continued on Page 35)**

SETS THE STANDARD FOR TRANSISTORS

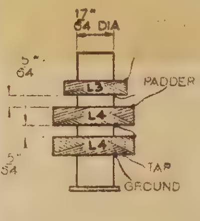

9V
+
50μF
470Ω
47KΩ
1KΩ
F
L1
415pF
40pF
·01μF
S
39KΩ
L3
S
F
L2
S
2N252
FERRITE ROD AERIAL
L5
L6
F
F
105pF
105 pF
2N308
L7
L8
190 pF
GD3
10KΩ LOG. POT.
AUDIO OUTPUT
·04 μF
S
S
S
S
L4
415pF
415pF
40pF
4700 pF
8·2 KΩ
3·3KΩ
0·1μF
6 8KΩ
0 1μF
0 1μF
1KΩ
10KΩ
25μF

FERRITE AERIAL COIL



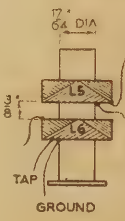
ROD: Standard Ferrite ⅜" dia., 8" long.
PRIMARY L1: 45 turns 7/41 B. & S. Litz wire.
SECONDARY L2: 5 turns 33 B. & S. double nylon-covered wire, wound over grounded end of primary.
TUNING CAPACITANCE: 40-450 pF.

OSCILLATOR COIL


17" 64 DIA
5" 64
L3
PADDER
L4
L4
5" 64
TAP
GROUND

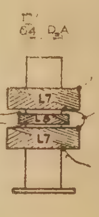
TUNING SLUG: 6 mm. dia. x ½" long.
CAN ASSY.: 1⅛" x ¾" x ¾". 9/16" i.d. x ¾" o.d. ring.
PRIMARY L3: 28 turns 33 B. & S. double nylon-covered wire.
SECONDARY L4: 2 pies in series, each 57 turns 8/41 B. & S. Litz wire tapped at 5 turns from grounded end.
UNLOADED Q: 85 at 975 kC/s.
INDUCTANCE: 120 μH.
TUNING CAPACITANCE: 40-450 pF.

1st I.F. TRANSFORMER


17" 64 DIA
3" 8
L5
L6
TAP
GROUND

TUNING SLUG: 6 mm. dia. ½" long.
CAN ASSY.: 1⅛" x ¾" x ¾". 9/16" i.d. x ¾" o.d. ring.
PRIMARY L5 } Each 285 turns 3/41 B. & S. Litz
SECONDARY L6 } Unloaded Q: 95. L: 1,150 μH.
SECONDARY L6: Tapped at 3 turns from grounded end.
TUNING CAPACITANCE: 105 pF

2nd I.F. TRANSFORMER


64 DIA
L7
L8
L7

TUNING SLUG: 6 mm. dia. ½" long.
CAN ASSY.: 1⅛" x ¾" x ¾". 9/16" i.d. x ¾" o.d. ring.
PRIMARY L7: 2 pies in serie 8/41 B. & S. Litz wire, each 13 turns, tapped at junction.
UNLOADED Q: 105.
L: 630 μH.
SECONDARY L8: 35 turns 3 B. & S. double nylon-covere wire.
TUNING CAPACITANCE: 190 pF

Australian-made S.T.C. transistors have proved their value in a vast number of applications. As the use of transistors grows, S.T.C., backed by world-wide research, is adding more new types to its already wide range. First to make transistors in Australia, S.T.C. keeps its lead in quality, reliability and performance.

RADIO TUNER UNIT

Shown above is the circuit diagram of a transistorised superheterodyne radio tuner unit which has been designed to cover the broadcast band. It may be combined with various transistor audio amplifier circuits to form a complete portable radio receiver.

Although the design is simple and uses few components, it is capable of good sensitivity and selectivity. The bias for each stage is obtained in a way which gives good temperature stability, and care has been taken to ensure that the transistors are being operated correctly.

Coil design data is given above and represents a good compromise between gain and selectivity.

PERFORMANCE

Frequency Range	530 to 1,620 kC/s
Sensitivity	Field strength of 300 μV/m gives 2 mV. output in 1,000 ohms
Overall Bandwidth	10 kC/s at the 3 dB. points
Battery Drain	Approx. 2 milliamperes

M182A

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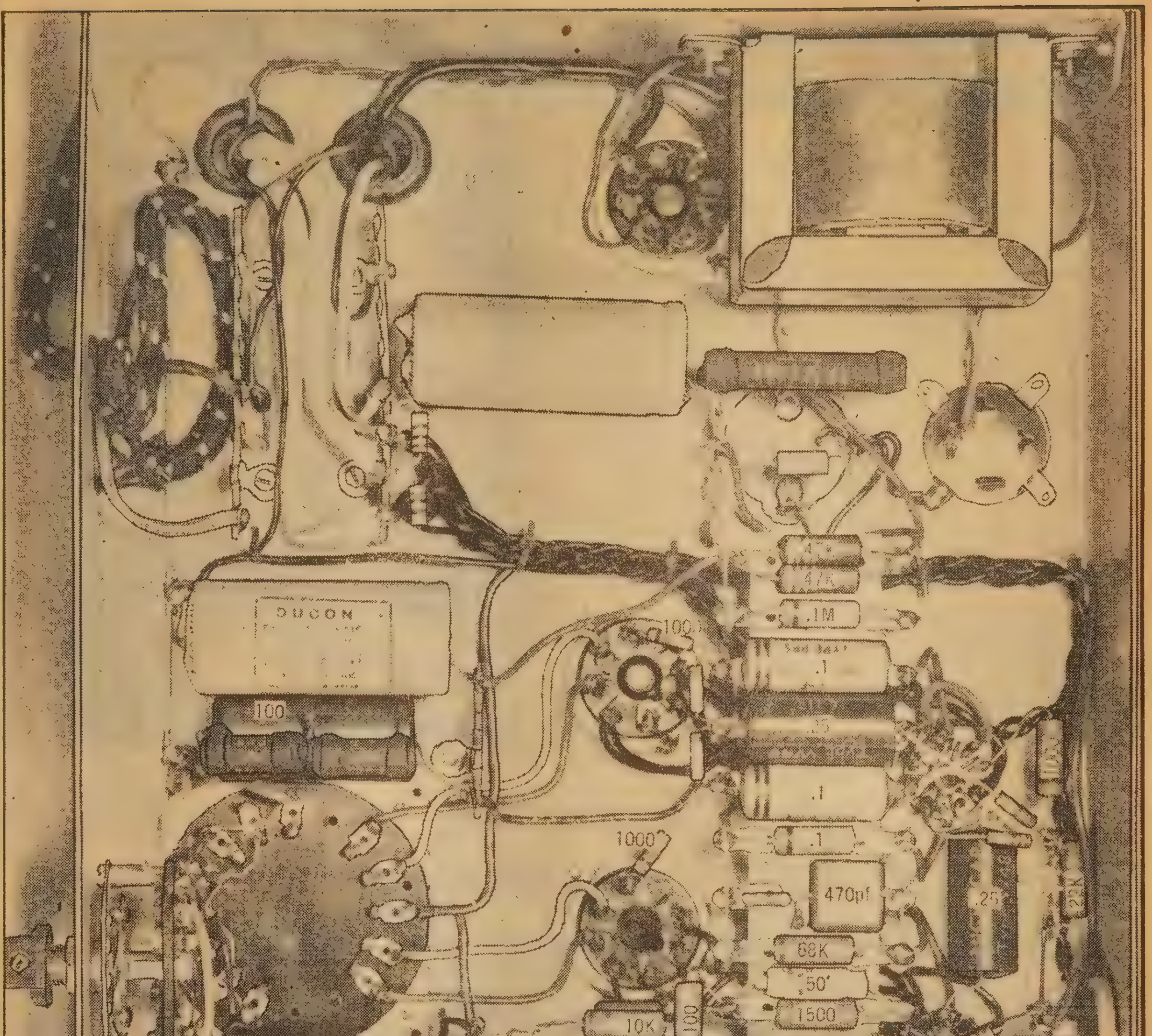
252-274 BOTANY ROAD, ALEXANDRIA
MX 0444


DUCOM
47K
47K
.1M
100
.1
.25
.1
1000
.1
470pf
68K
.50
1500
10K
100
100pf
10K
100pf
100
1500
.50
68K
470pf
.25
22K
22K
100
100
1000
.1
.25
.1
1000
100

The layout is similar to that of the earlier 10-watt amplifier—in fact it is virtually indistinguishable. This design has been lined in so that as many components as possible can be clearly seen. Construction is centred around the component strip which should be wired up before installation The central earth point is the bolt through the strip immediately behind the 6CG7. Amplifier sensitivity for full output is approximately 200 millivolts, and feedback is adjusted to 22db per channel.

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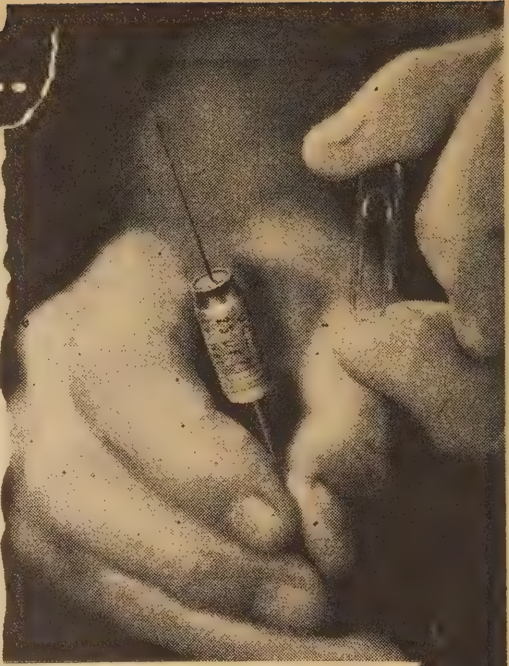

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We have included a phasing switch at the rear of the amplifier which enables you to check the speaker phasing without moving from the operating point, and it is quite valuable if the amplifier should be moved from place to place, as ours often is for various reasons. Speaker phasing is quite essential for stereo, and quick change facilities for the price of a simple switch, which is probably in your junk box in any case, are well worth while.

When building the amplifier, make up the small components panel before mounting it in the chassis, and complete all the filaments, etc., before it goes into place. It is a great help in saving time and simplifying construction, it ensures best possible balance of leads, and makes an extremely neat and workmanlike job.

A point to watch is the orientation of the power and output transformers. These can be placed close together as long as the cores of the output transformers are both at right angles to that of the power transformer, and their centres are lined up.

HUM DANGER

If you don't do this you are bound to experience hum pickup from the power transformer directly into the output stages which no amount of filtering can remove as its cause is quite exterior to the power circuits themselves.

Fortunately, TV transformers are designed to have a low external field and are almost always fitted with a copper strap to reduce the field still further.

A test for this hum pickup is to remove all the valves and connect the amplifier to the power mains. If there is coupling into the output transformers you will hear it in the form of a low hum. If all is in order there should be nothing heard even close to the loudspeaker cones.

The performance of the amplifiers is similar to that for the latest versions of the 17-watt designs, and in our experience is not excelled by any other amplifier which has been tested by us, providing the highest grade of output transformers is used.

Frequency response is virtually flat to about 100 Kc and a general slope from then on at about 6 db per octave can be expected. Both frequency and power response will extend below the region of 30 cycles with negligible drop and substantially full output can be expected to at least 20 Kc.

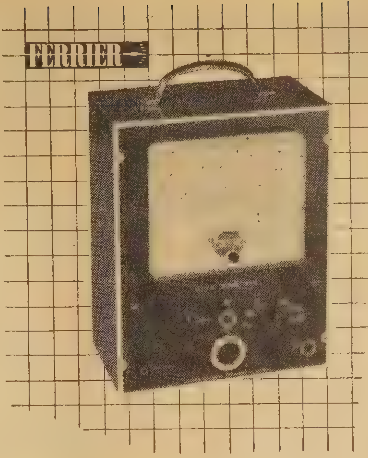
FEEDBACK

The main feedback loop is again limited to about 22 db, which is ample to provide excellent loudspeaker damping and very low distortion.

Measurements indicate that frequency distortion should not be greater than a fraction of 1 per cent up to 15 or 16 watts, and not exceed this figure until about 17 watts is reached. As this amount of power is only likely to be reached on occasional peaks under very high-powered conditions, this type of distortion can be considered quite negligible over any normal operating conditions.

Square wave checks with the transformers used indicate almost perfect patterns at 5 Kc under any conditions of load, including open circuit, 15 ohms resistive, 15 ohms speaker load and a standard 3-section cross-over network. Again, this performance has not yet been equalled by any amplifier we have yet tested.

(Continued on Page 102)



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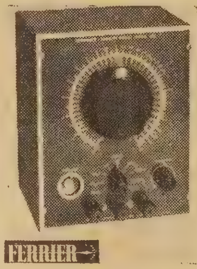

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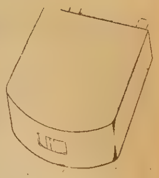

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FROM THE SERVICEMAN WHO TELLS

The proximity of TV in the remaining four States is no doubt being anticipated with mixed feelings by those concerned; an undoubted eagerness to see and work with it, mixed with a natural apprehension about the technical problems involved. It is to these fellows as much as anyone that I direct most of my remarks this month.

THE particular problem I want to discuss has been with us almost since the inception of our service. It has, in fact, now slipped back into relative obscurity as one of the routine troubles which is diagnosed and cured almost automatically, much like the open screen resistor we seek when an audio stage drops gain suddenly, or the open speaker transformer when a screen gets hot and bothered.

Perhaps this acceptance of the trouble is the reason, but I realised while handling such a job the other day that I couldn't remember ever having written anything about it, or having read much about it other than in some of the more obscure technical articles aimed at the designer rather than the serviceman.

While my comments may be nothing new to the local boys, I feel sure the would-be TV technicians of Brisbane, Adelaide, Perth and Hobart will find them helpful. (And don't worry too much, chaps. You'll take it in your stride when the time comes.)

CHANNEL 2

Briefly, the trouble concerns interference patterns on Channel 2, particularly in suburban areas where signal strength may be very high. Although fundamentally a problem of receiver design, a serviceman struck with such troubles should be aware of what can be done without resource to major receiver changes.

The general name for this trouble is "herringbone effect"; a term which may appear a little confusing to the beginner at times, so it might be worthwhile to consider just what conditions produce the various effects.

The simplest form of interference is the beat pattern. This will be produced when two signals beat together to produce a third signal with a frequency within the video band, i.e., up to 5.5 Mc. This will produce alternate light and dark areas or "bars" on the screen, being roughly horizontal if the frequency is below the line frequency (15,625 cps) and vertical if the frequency is higher

2Mc. AND UP

It is the vertical bars which concern us most, since most of the beats encountered are around 2 Mc or higher Fairly obviously the higher the beat frequency, the greater the number of bars on the screen.

Unless the two frequencies producing the beat are rigidly locked together (as in the case of the sound and video carriers), the inevitable drift between them will cause the pattern to wander across the screen, tilt from the vertical or horizontal, and even vary in respect to the number of bars.

From this it is easy to imagine that something drastic is bound to happen to the pattern if one of the carriers is caused to change frequency very rapidly, i.e., if it is frequency modulated. The nominally vertical bars now take on a zig-zag form resembling the herringbone weave in cloth, thus giving rise to the term "herringbone pattern."

One of the best known examples of this effect is the 5.5 Mc beat produced by the difference between the sound and video carriers. While this normally is filtered out by means of a 5.5 Mc trap in the video amplifier circuit, it can become apparent when this trap is incorrectly set, of poor design, or when excessive signal is encountered.

FINER PATTERN

It, too, produces a vertical bar pattern; but since the spacing between the bars is comparable with the spacing between horizontal lines, it appears more as a fine dot pattern. That is, until the sound carrier is frequency modulated, whereupon the characteristic herringbone pattern appears once more.

From this it will be seen that any interference pattern which involves the sound carrier (or any other frequency modulated carrier, for that matter) can be expected to change its form from a bar pattern during periods of no sound, to a simple herringbone pattern when a steady tone is being transmitted, and to a much more complex herringbone pattern when speech or music is involved.

If these foregoing points can be fully appreciated and remembered, it will be a good deal easier to recognise the patterns when they are encountered. And, take it from me, that's half the battle.

As to the causes of these beats, there are many and varied possibilities. In fact, it would seem that any bright mathematician should be able to sit down and work out possible combinations of fundamentals and harmonics almost ad infinitum—or, at any rate, until his slide rule ran hot or wore out.

In practice there appear to be only two or three possible combinations which are likely to prove really troublesome, and of these (to judge from experience) a 2.25 Mc beat appears to be the worst.

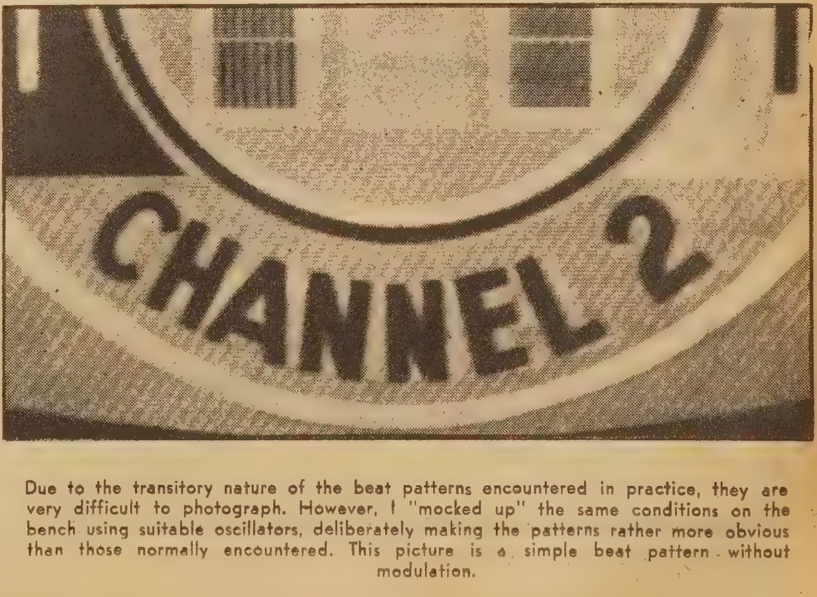
This effect takes place in the mixer section of the tuner where, as in any mixer stage, it is very easy to produce harmonics by reason of the non-linear mode of operation fundamental to all mixing devices.

Under certain operating conditions, generally when called upon to handle a large signal, the video IF (36 Mc) will produce sufficient second harmonic (72 Mc) to beat with the sound carrier (69.75 Mc) and produce a 2.25 Mc signal.

This shows up as a bar pattern under no-sound conditions and as a herringbone under sound conditions. Because the 36 Mc video IF is purely nominal and at the mercy of any local oscillator drift, the pattern will not be stationary, but will tilt back and forth in a purely random fashion. In addition, the same effect can be obtained by shifting the fine tuning control.

HARDER WITH SOUND

It frequently happens that the effect is less obvious when sound modulation breaks it up into herringbone than when it is a simple bar pattern. Similarly, it will be more obvious on some types



Due to the transitory nature of the beat patterns encountered in practice, they are very difficult to photograph. However, I "mocked up" the same conditions on the bench using suitable oscillators, deliberately making the patterns rather more obvious than those normally encountered. This picture is a simple beat pattern without modulation.

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of picture than others. Low key pictures, in general, will show it up most, particularly where no DC restoration is provided and the black level drifts to a grey.

By calculation there should be approximately 160 vertical lines produced by this frequency, but this will be reduced by the flyback period and whatever horizontal overscan there may be. In practice, something nearer 120 lines would be more likely, but this information is rather more academic than practical, since it would take a wizard to count the lines in a typical weaving pattern broken up by sound.

Another possible frequency combination is that of the sound carrier (30.5 Mc) producing a second harmonic (61 Mc) to beat with the video carrier (64.25 Mc) and produce a 3.25 Mc beat. Apart from a larger number of lines, we would expect this pattern to behave in a manner similar to the 2.25 Mc condition.

It is generally agreed that the correct way to cure these troubles is by proper receiver design in the first place. In the mixer stage itself the correct choice of mixer valve and mixer operating conditions are the main factors to be considered. In addition, the receiver as a whole should be capable of generating sufficient AGC voltage to ensure that the RF stage is adequately controlled, thus reducing the signal strength at the mixer to a level with which it can cope.

STILL A PROBLEM

Unfortunately not all sets reach this standard even now, although there is evidence of an increasing awareness of the problem and its causes. Thus we still encounter this trouble, both in new sets and in old sets which have been moved into less favourable areas.

Another basic cause is radiation of harmonics of either the sound or vision carriers from the video detector, these being picked up by the aerial feeder and fed back into the tuner. Once again there appear to be a large number of possible combinations, and it may even be difficult to decide whether these combinations are taking place in the mixer or video detector, or both.

More important is how we tackle these problems from a servicing angle, i.e., without making any radical changes to the design of the set.

Since any such tendency in the set design is usually aggravated by high signal strength, we generally aim at reducing this in some manner. The simplest approach is the resistive type attenuator pad sometimes recommended where serious ghosting problems have necessitated the use of an aerial having, among other things, a higher than desirable gain.

SNOW

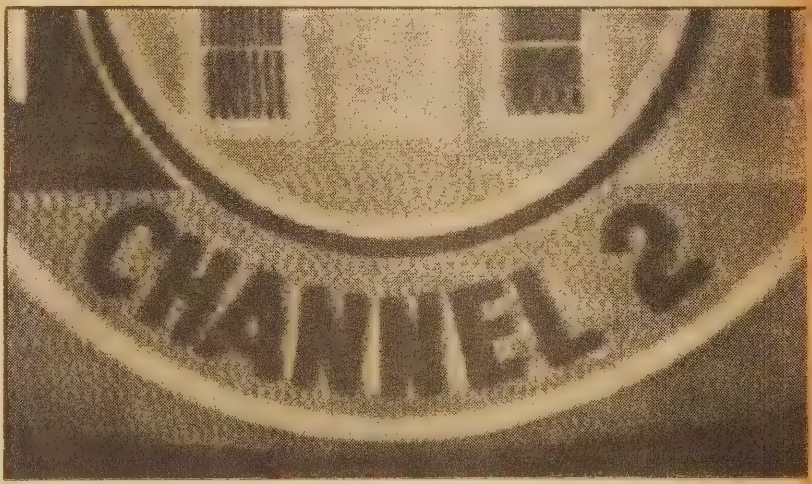
Unfortunately it often happens that such a situation is encountered in a shielded locality, and that Channel 2, due to its more favourable frequency, will be markedly stronger than channel 7 and 9. Thus, by the time Channel 2 has been reduced by the required amount, the other two have almost vanished in a flurry of snow.

What is required is a selective attenuator of some kind, which will be effective on Channel 2 only, and this is the basis on which most of these problems are tackled. The procedure is now so widely accepted that commercial traps for the purpose have been available for some time.

Fairly obviously, any trap designed to attenuate the video carrier would have to be designed to provide equal attenuation over the whole video pass band if it was not to upset the final video response curve. Such a device, if not completely impractical would be at least complex and expensive.

The sound carrier, on the other hand, presents no such problems and, since it is as much the offender in most cases as the video carrier, there is every reason to suppose that attenuation of it may at least alleviate the problem. In practice, it usually effects a complete cure.

This approach requires only the simplest of filters. A series tuned circuit, capable of being adjusted to the sound carrier (69.25/Mc) and over a few megacycles on the high side of this figure, is all that is required. It is connected directly across the aerial input terminals.



When the sound carrier is frequency modulated the pattern breaks up into the classic "herringbone" design. Depending on the modulating frequencies involved, the pattern may vary considerably from the above, often being more streaky in nature and harder to identify behind a moving picture.

By presenting a very low impedance at its resonant frequency it effectively shunts the input circuit at this frequency, and provides considerable attentuation. By tuning the trap toward the sound carrier from the high frequency side, the exact amount of attenuation required can be selected, without risk of encroaching on the video pass band.

The case which prompted me to write these comments is so typical of what is likely to be encountered that I feel it is worth describing briefly.

The owner complained of "funny stripes" on the screen, explaining that they were not always visible, but that they sometimes proved most annoying on dark scenes, in which they were very evident. Although it was obvious that he hadn't thought much about it, he agreed when I asked him, that the trouble was confined to Channel 2. However, he had noted that the effect could be altered by adjusting the fine tuning control, even though this would not eliminate it.

TRAP DETAILS

The evidence seemed conclusive enough and I was all for making good use of a slack period by going straight to the job and fitting the usual filter. (Fairly obviously, such cases should always be checked "in situ," in order that the exact signal strength conditions are not disturbed.)

A minor snag was that I had no ready-made filter on hand but, remembering the days before such things were available, I decided I could revert to a home-made one on this occasion.

A popular trick employed by many servicemen is to take a standard commercial winding, such as a video trap coil, and modify it by removing turns until the required resonance is obtained

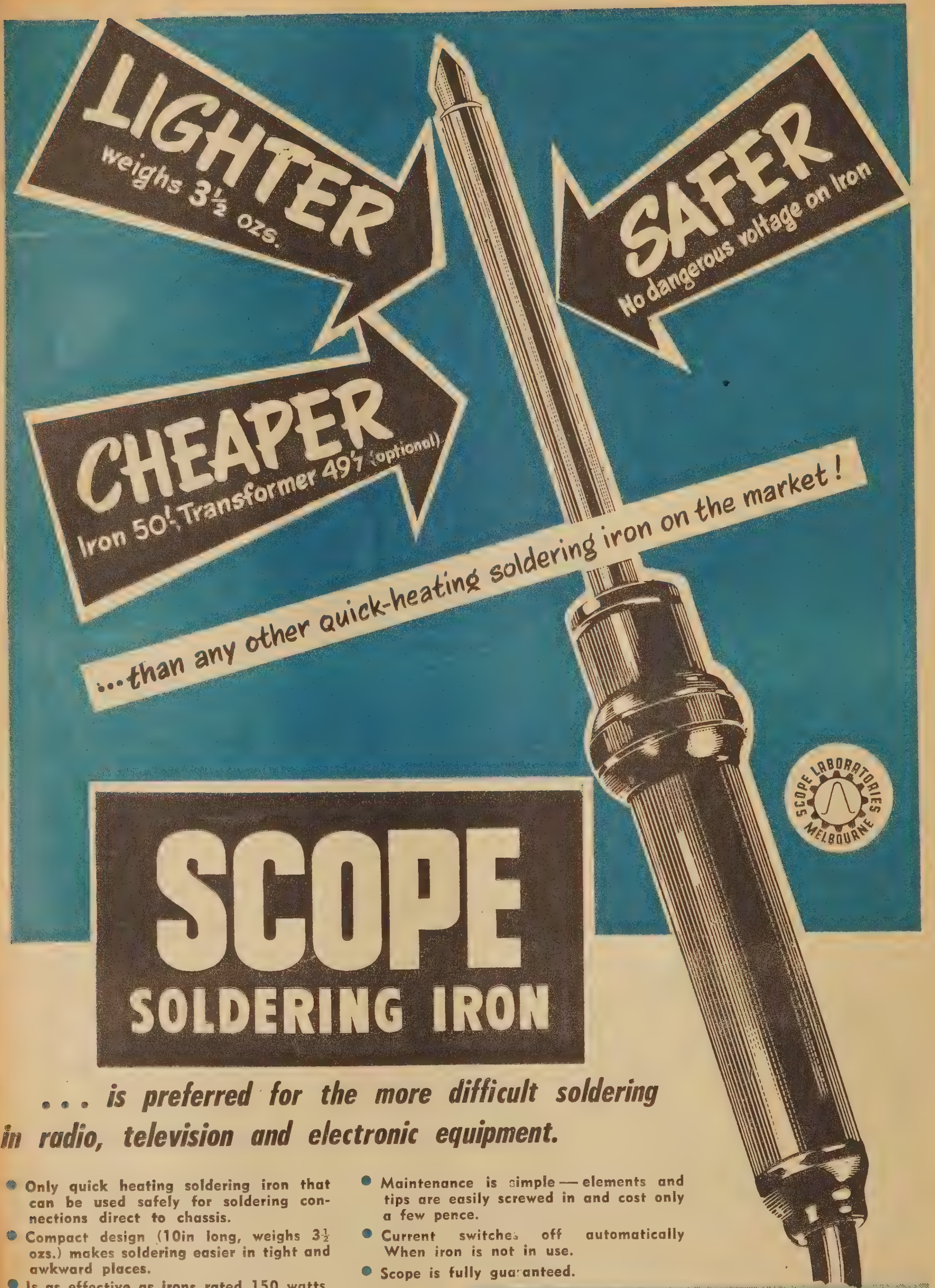
In this case, I had on hand a moulded former which had been intended for some similar application, though just how I happened to have it in stock I can no longer remember. However it looked to be an ideal starting point.

The former diameter was 8 mm and working from memory I wound on five turns of 18-gauge enamelled wire. In series with it I connected a 10 pf capacitor. Shorting the two active terminals to make a parallel circuit I checked it on the grid dip oscillator for signs of resonance around 70 Mc. Perhaps I was lucky, or my memory good, but I found the dip with the core nicely positioned well into the winding. With the core right out the dip was well up into the 80-odd megacycle region; ample range for what was required.

At the customer's home I made a careful check of the symptoms he had described. There seemed little doubt that the trouble was as I imagined, but I couldn't help realising just how insidious this fault can be. When I was lucky enough to strike a fade-out between scenes, with little or no sound, there was no doubt about it, the "stripes" were clearly defined.

But on normal scenes, accompanied by sound, the resultant pattern was quite hard to identify. There was no doubt that something was wrong, since the picture was noticeably degraded, but the exact cause could be very hard to pick unless one was aware of what to expect.

Which suggests that servicemen and installation technicians alike would be well advised to check very carefully for signs of this trouble. I would say it would be all too easy for a careless operator to overlook such a condition, and dismiss the degraded picture as due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to faulty program material, or other cause not associated with the receiver.

Of course this is not always so. The worst examples simply cannot be ignored, but those which might be described as borderline cases might easily be overlooked.

Another interesting observation is that this fault seems to degrade tele-recorded film images more than good quality film or studio images. I imagine this is due to the fact that there are two sets of line structures, one on the film and one in the image proper. These produce noticeable interference patterns anyway and, when a third pattern is added, the effect is bound to be serious.

Fitting the filter was simply a matter of connecting the two lugs under the aerial terminals on the back of the set, the slug having been well set out of the coil to put the circuit on the high side of the sound frequency. Then I commenced screwing the core in while listening carefully to the sound level.

CHECK THE SOUND

For the reasons already discussed it is not always easy to decide at just what point the pattern has vanished completely, at least, not without spending a lot of time checking the picture for any one setting. The simpler method is to screw the slug in until a marked dip in the sound level is encountered, then back off until the sound level is just adequate (with a reasonable reserve) but no more.

In short, if the sound carrier is reduced by as much as can be tolerated, the pattern will be attenuated by the maximum amount possible and the result, whatever it is, will have to be more or less accepted. In most cases the cure is virtually complete under these conditions.

In this case the trap was able to reduce the sound to a very low level but, even at a reasonable level, there was no sign of the pattern. It is important to appreciate that the amount by which the sound carrier appears to be attenuated depends on the set, and can be deceiving.

Those sets with only moderate gain in the sound IF channel will show a more pronounced dip than those with higher gain systems, due to the more effective limiting in the latter case. However, this does not mean that the trap is not doing its job as effectively.

VERY EFFECTIVE

Having set the coil correctly I was able to demonstrate its effectiveness to the owner by temporarily disconnecting one lug from the aerial terminal and moving it on and off. I was able to show that the pattern vanished completely under all picture conditions, and the improvement to the picture was so marked that he could not fail to appreciate it.

When I left I knew I had produced at least one happy customer for that day.

To finish off this month, and in contrast with all our foregoing TV discussion, I have a story concerning a humble five-valve mantel set with nothing more exciting wrong with it than a noisy volume control.

Routine, you say? Well, perhaps, but it did have an element of mystery in it. (No pun intended!)

When the customer delivered the set and made his complaint, there did not appear to be anything unusual about the job. I imagined I would simply fit a new pot. and send it on its way.

When I did get around to checking it, I realised that the owner's complaint was a masterpiece of understatement. The pot. must surely have been the noisiest I have ever encountered. The merest touch of finger on knob was enough to bring forth a burst of crackles from the speaker, while every attempt to rotate it, no matter how slowly or gently this was done, produced a frightening series of crashes. I did, in fact, have serious doubts as to the speaker's ability to stand too much of such treatment.

When I started to take the chassis out of the cabinet, I found it vaguely familiar, with the feeling that I had handled it before some time. This was strengthened when I turned it over and glanced at the offending pot. It had that unmistakable appearance which a new component always presents in an old chassis.

A check through the record file confirmed my suspicions. The set had been serviced only a couple of months earlier, and for a noisy pot., which had been replaced. Why, then, did it need another one so soon?

One thing was certain. Any pot. which failed as quickly—and as completely—as this one had, needed to be investigated. More correctly, the complete set-up needed to be checked, since the fault may not have been in the pot. itself.

DC?

The most likely possibility in such cases is that of DC voltage between the moving arm and the element and generally due, in turn, to a leaky coupling capacitor somewhere in the moving arm circuit.

However, a careful examination of the circuit failed to reveal any such condition, and I was forced to the conclusion that it was indeed the pot. which had failed.

Still anxious to know why, I lifted it out of the chassis and prized the cover off, expecting to find some obvious mechanical fault. Instead, I found the most atrocious mess I have ever encountered in such a component. The whole of the "works"—element, wiper arm, sliding contact, etc.—were literally drowned in oil. Not grease, but oil about the consistency of ordinary household machine oil.

How had it got there? Frankly I don't know. My first reaction was to blame the owner for "oiling" the thing on some pretext or other—not an uncommon happening in years gone by. However, when I subsequently questioned him on the point he denied all knowledge of it. And, at the expense of spoiling a good story, I'm afraid I was forced to believe him.

More important at the moment was whether it was worthwhile trying to salvage it. Mainly to see just what could be done, I decided to have a go at it.

CLEANING TECHNIQUE

Removing the circlip holding the main shaft in place, I removed the latter and concentrated on the main section. With a clean cloth, and aided by a drop or two of methylated spirit, I was able to remove most of the mess. The element worried me most, but even this looked encouraging when I had finished. Finally, a squirt of carbon tet. and another wipe over seemed to be about all I could do.

I treated the shaft assembly the same way then, before putting it back in place; I applied a very light smear of good quality petroleum jelly to the bearing surface. I was determined there was going to be no surplus lubrication this time.

Replaced in the chassis and checked, it behaved without a murmur, as quiet as a brand-new unit. After a more prolonged test, which it survived without effort, I felt justified in taking a chance on it. As far as I could see, there wasn't any reason why it shouldn't last as long as a new one—as long as someone didn't oil it again.

Just how this happened, in the first place, must remain a mystery. If the owner didn't do it—and I am convinced he didn't—then who did? Could it have happened during manufacture, due to one of those thousand-to-one chances whereby some new or inexperienced operator mistakes his orders, and the error is overlooked by all subsequent checking operations?

As I said, I don't know, but it's a nice little mystery to ponder over.

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FACTS ABOUT PHOTOFLASH BULBS

Since it seems inevitable that radio enthusiasts turn to photography as a companion hobby, any discussion combining electronics and photography is bound to have a wide appeal. A recent engineering bulletin from the Eveready Co., on the problems of firing expendable flashbulbs, struck us as being particularly instructive. We are therefore reprinting it by kind permission of this organisation.

AS originally received, this paper dealt with lamps currently available on the American market, but not available in this country. In order to relate the information to lamps which our readers are likely to use, we have modified the first part of the article to suit the local market. Most of the lamp data and diagrams for this purpose was kindly supplied by Philips Electrical Industries Pty. Ltd. However, the information would apply equally to other makes having similar characteristics.

Three sources of flash illumination have been used up until the present time: flash powder, expendable photoflash lamps and high voltage repeating flashtubes. Except in rare cases flash powder is not used today, having been replaced by the latter two sources of light.

Expendable photoflash lamps, introduced in 1930, are widely used by professional and amateur photographers. Repeating flashtubes, which require a high voltage power supply, are gaining in popularity. The comments that follow apply exclusively to systems for firing expendable photoflash lamps.

COMPLEX PROCESS

When the firing switch on a flash gun is pressed, it starts a complicated train of events, all of which occur in a very short time interval. Inside the flash bulb are two filament support wires, mounted in the "pinch" in the same way as in a conventional globe.

These supports are bridged by a thin wire filament, and the upper ends of the supports are coated with a primer which ignites when heated. The light-producing aluminum wire "combustible" occupies the space surrounding the filament. The lamp envelope is filled with oxygen, to sustain vigorous combustion.

When a surge of current flows through the photoflash lamp filament, the resulting heat ignites the primer. The primer in turn ignites the aluminum wire, and light is given off as the aluminum burns. While this action occurs very rapidly, it still takes a finite time interval for the light to reach its maximum, or peak, value. Fig. 1 shows how the light output changes as time progresses in the case of a typical lamp.

It will be seen that it takes about 20 milli-seconds (.02 second) for the light to reach its peak, after which it diminishes at a rate somewhat slower than it built up.

FIRING TIME

Photoflash lamps are available with different time-light output curves. Typical lamp performance graphs are shown in Fig. 2 showing the time-light relationship for various current types. The following brief descriptions explain the characteristics of each class of lamp.

1. Class F, or fast peak. These lamps have a large amount of primer material, but no aluminum combustible in the lamp envelope. They are used almost exclusively by amateur photographers in inexpensive flash cameras. The absence of aluminum wire permits them to reach their light peak in approximately 5 milliseconds. Their total light output is less than aluminum-filled lamps, since all of the light is produced by the primer.

These types are not available in Australia at the present time.

2. Medium Speed — Class M. The PF25N lamp is typical. The time-to-peak is approximately 20 milli-seconds. Several sizes of lamps are available, having different amounts of light-producing combustible material in the lamp envelope. While the total light output is different for each type of lamp in this class, the time-to-peak is the same. Typical Class M lamps available, listed in order of light output are: PF25N, PF38E, PF60E.

3. Slow Speed—Class S. These are big lamps with a large amount of combustible material in the lamp envelope, used where a great deal of light is required. Because of the increased amount of combustible, the nominal time-to-peak is 30 milliseconds, or 50 per cent longer than for smaller lamps. A typical type is the PF100E.

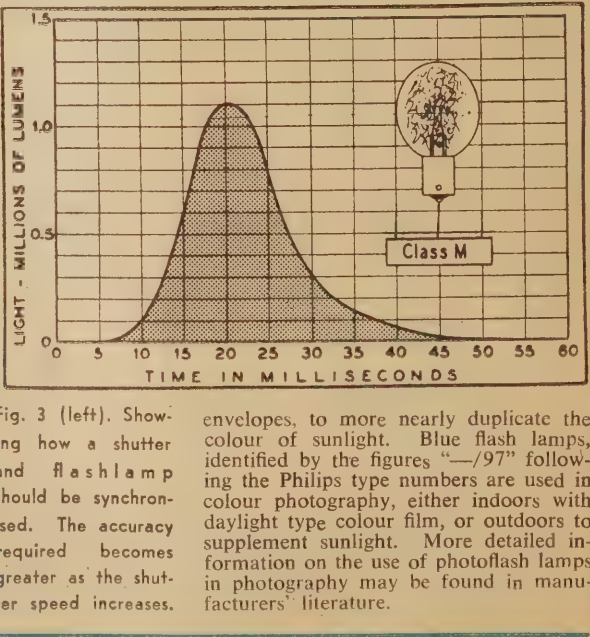
4. Focal Plane—Class FP. These lamps have long, flat peaks so that the light intensity remains essentially constant as the slit in the focal plane curtain traverses the unexposed film. As shown in Fig. 2 in the PF45E the "plateau" of the light curve is reached 20 milliseconds after the filament circuit is closed. The light curve then remains almost flat to the 40 millisecond point, after which it diminishes, reaching extinction after a total time of approximately 60 milliseconds. Typical focal plane lamps are: PF24N, PF45E.

LATEST MINIATURES

The latest type of flash bulb to be introduced is the miniature "baseless" type. Small in size, and low in cost, it appeals particularly to the amateur, for whom it normally provides adequate light in spite of its small size. Types PF1 and PF5 are examples and as can be seen from the graph, these reach their peak in 17 to 20 milliseconds. They may thus be included in the "Class M" type of lamp.

All of the photoflash lamp types listed above have clear glass envelopes. Certain of them are also available with blue envelopes, to more nearly duplicate the colour of sunlight. Blue flash lamps, identified by the figures "—/97" following the Philips type numbers are used in colour photography, either indoors with daylight type colour film, or outdoors to supplement sunlight. More detailed information on the use of photoflash lamps in photography may be found in manufacturers' literature.

Fig. 1 (right). Light output vs. time as plotted for a typical "Class M" (medium speed) lamp. Peak is reached in 20 milliseconds. "M" setting on shutter gives approximately 18 milliseconds delay.



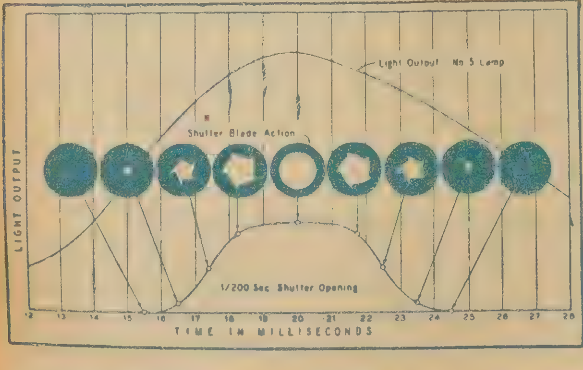


Fig. 3 (left). Showing how a shutter and flashlamp should be synchronised. The accuracy required becomes greater as the shutter speed increases.

(Philips Electrical Industries have prepared pamphlets, available gratis, giving very comprehensive data on available lamps, their characteristics, light output, etc., as well as the guide numbers to be used for virtually any film available on the Australian market.)

As mentioned earlier, the use of flash lamps complicates photography, for the shutter must be open during the brief interval of maximum light; otherwise, maximum available exposure will not be realised. The maintenance of good synchronisation between light peak and shutter action depends to a large degree upon the power source used to fire the lamps.

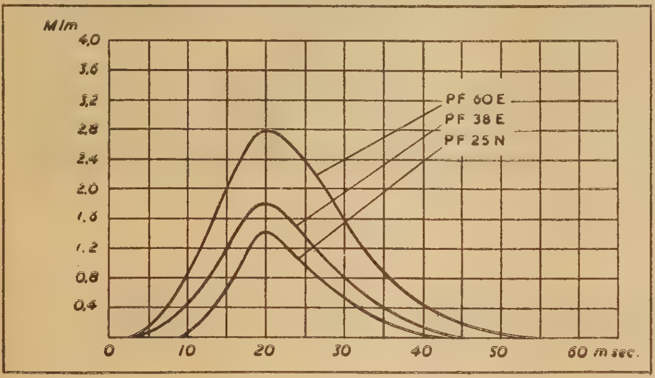


Fig. 2a. Light output curves for three popular "Class M" lamps. Note that only the light output varies, the peak time remaining constant at 20 milliseconds.

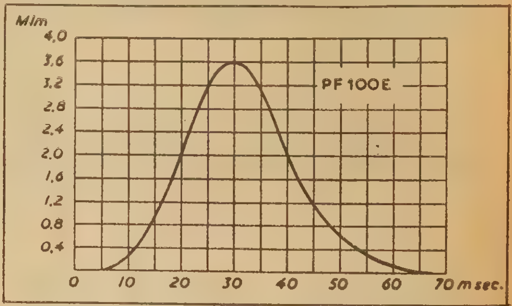


Fig. 2b. The curve of the "Class S" (slow firing) lamp, used when high light outputs are required.

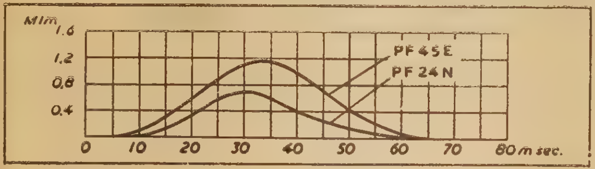


Fig. 2c. Curve of the focal plane shutter type lamp, showing the "flat" response essential for even illumination.

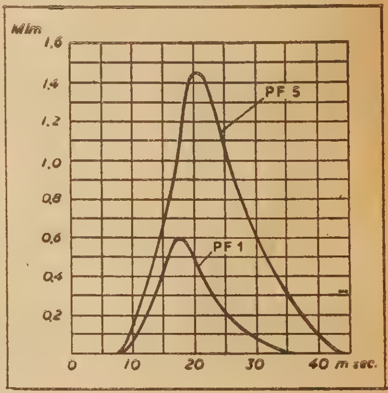


Fig. 2d Response of the latest type of flash bulb; the "baseless" midget. Peak time varies between 17 and 20 milliseconds, putting these units in the "M" class. Light output is lower than other types, but still adequate for amateur use.

Originally, all small photoflash attachments used two or three flashlight size dry cells to provide the energy to fire the lamp and also, in some cases, trip the shutter. In this equipment, battery condition has a profound influence upon its effectiveness. The battery's size, its age, and its internal resistance all affect its operation.

MULTIPLE LAMPS

Many photographers, particularly those in the professional class, fire more than one photoflash lamp when taking pictures. The synchronisation problem then becomes more severe, for all of the lamp peaks must coincide with each other, and with the shutter action, to be effective. The next part of this bulletin will take up the synchronisation problem in greater detail.

As mentioned previously, the big problem in flash photography is to set up the proper time relation between the lamp light peak and the shutter action. This is particularly important at high shutter speeds (1/100-1/200 second), when the time during which the shutter is open is of the same magnitude as the flash peak duration, or at higher speeds (1/400-1/800 second) when the shutter-open time is considerably less than the flash peak duration. Fig. 3 shows the problem in chart form. Here the progressive action of a high-speed shutter is shown in proper relation to the light from a typical photoflash lamp.

The blades of the shutter are fully closed at the left. As time progresses the shutter blades open, remain open for a short interval, and then close again. In Fig. 3, the shutter speed setting is 1/200 second. It is apparent that the entire action occurs in a very short space of time. Shown with the shutter is a typical light output curve, plotted to the same time base as the shutter action. With good synchronisation, the centre of the shutter-open time coincides with the centre of the light peak.

The delay between circuit closure and light peak in each type of photo-flash lamp, while subject to some variation, must be considered to be fixed at the nominal value specified by the manufacturer in working out synchronising devices. The problem then becomes one of working out a method, either mechanical or electrical, for opening the shutter at the correct time. This is not a simple problem.

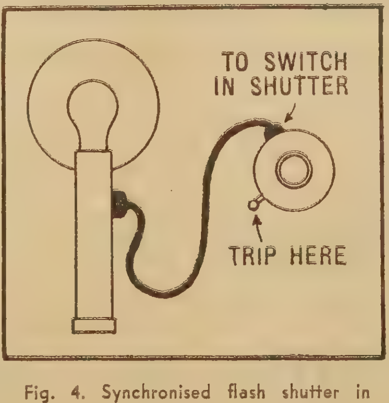


Fig. 4. Synchronised flash shutter in use. Required delay is built in to the shutter.

The synchroniser designer must work with light and electrical measurements. While this is not basically difficult, certain precautions in electronic circuitry must be observed. The circuits involved must be capable of response to rapid changes in voltage or current. The response of the circuits must also be linear over a wide range of voltage, so that the voltage or current observed is directly proportional to the light being observed, which varies from very small values to peak values three or four times that of bright sunlight.

The basic unit of time measurement in photoflash photography is the millisecond, or 1/1000 of a second. In this length of time a car going 60 miles per hour travels about one inch! Special equipment, running into hundreds of pounds, is required for precise measurement of the short time intervals involved. The problem is further complicated by the numerous combinations of shutters and flash lamps that exist in the photoflash art.

SYNCH. SYSTEMS

Photoflash synchronisation is accomplished in any one of five different ways, with modern cameras.

1. Open Flash. . . . Here synchronisation is established by the photographer. He is, in fact, the "synchroniser." To take a picture by open flash, the photographer puts the camera on a firm support with the shutter speed selector set at "B" or BULB, and he holds a simple flash gun in one hand.

Then to take the picture he depresses the shutter lever with the other hand, keeping the shutter open. Next he presses the flash gun switch, firing the lamp. Then he releases the shutter lever, permitting the shutter to close. This entire

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action may be accomplished in one second or less, with practice.

The minimum time required is still too long to permit such picture taking in any but reduced ambient, or background, light; otherwise the ambient light reflected by the subject will dominate the illumination supplied by the flash lamp. In open flash, the time of exposure is governed by the photoflash lamp's light characteristic.

LOTS OF LIGHT

This method is used with inexpensive cameras; also with commercial or Press cameras when the photographer requires all of the light available from the flash bulb, or bulbs, and subject motion is not a problem. Open flash technique may be used with any type of flashbulb.

2. Flash shutter . . . most modern cameras are equipped with flash, or synchronised, shutters which have a built-in switch that closes at the proper instant to insure that the shutter blades will be open during the light peak. A typical combination is sketched in Fig. 4. A simple flash gun is connected to the shutter contacts as shown. Ideal shutter and lamp characteristics are shown in Fig. 5.

Fig. 5a shows the relation required for correct synchronisation with Class F, or 5 millisecond, lamps at a shutter speed of 1/100 second. As indicated, the switch contacts close a short time prior to the instant that the shutter blades start to open. Then the light peak is bracketed by the shutter-open time. In some shutters the blades start to open at the instant the switch closes. Good synchronisation is still achieved because the Class F lamp reaches its light peak in only 5 milliseconds.

The Class F lamp thus permits flash shutter operation in very inexpensive cameras, for a simple shutter design will accommodate the necessary time relationships.

The solid white line in Fig. 5b shows the shutter action necessary to accomplish good synchronisation with a Class M, or 20 millisecond lamp at 1/100 second. To effect this time relationship, it is essential that the shutter switch contacts close considerably before the shutter blades are released. In some cameras a delay lever must be cocked to inject the required delay in the time that the shutter starts to open. In others the delay is automatically set up, once the shutter is adjusted for Class M lamps.

USING EXTERNAL SYNCHRONISERS

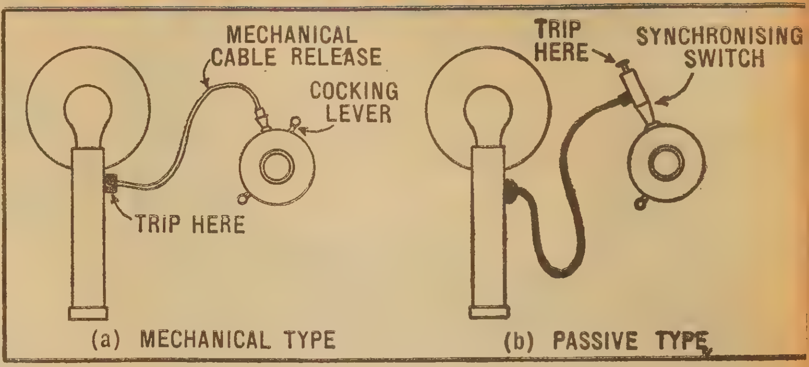


Fig. 6. Two types of mechanical synchronisers. Used with shutters having no built in delay.

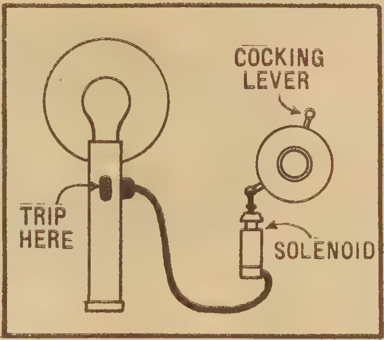


Fig. 7. The electrical synchroniser, using a solenoid to trip the shutter. The solenoid provides the delay.

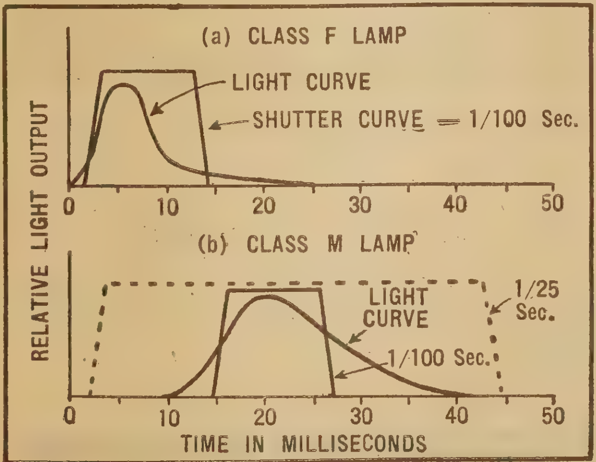


Fig. 5. Ideal time relations in synchronised flash.

In any case, the delay is essential at shutter speeds of 1/50 second or higher. At low shutter speeds (1/25 or 1/10 second), the opening of the shutter blades need not be delayed, for the shutter is open long enough to encompass the entire light peak, as indicated by the dotted white line in Fig. 5b.

Most flash shutters that maintain synchronisation to 1/200 or 1/400 second are the pre-set type . . . a cocking lever "sets" the shutter and a release lever trips it. Self-cocking shutters are inherently slower acting than pre-set types, and synchronising problems are thus not as severe.

3. Mechanical synchronisation . . . synchronisers are available in which energy to flash the lamp, or lamps, is derived from small dry cells, but the energy to trip the shutter is mechanically supplied. With this type of synchroniser, older types of pre-set shutters may be used with Class M photoflash lamps at high shutter speeds. The combination is sketched in Fig. 6a.

PLUNGER SWITCH

In use, the shutter is cocked as usual, but tripped by a cable release cord connected to the cable release socket on the shutter housing. The cable release is terminated at the flash gun in a plunger switch of special design. The switch is worked out so that a pair of electrical contacts in the flash bulb circuit close before the cable release trips the shutter. This time relationship is adjustable, and when adjusted correctly, the lamp light output and rapid shutter action will be related as shown by the solid white line in Fig. 5b.

(Synchronisers using gear trains to provide the required delay are currently available on the Australian market. Most of these remarks would apply equally to this type. They appear to give a high order of reliability.)

In using this type of mechanical syn-

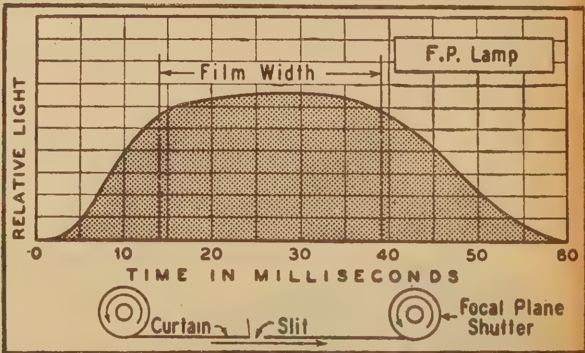
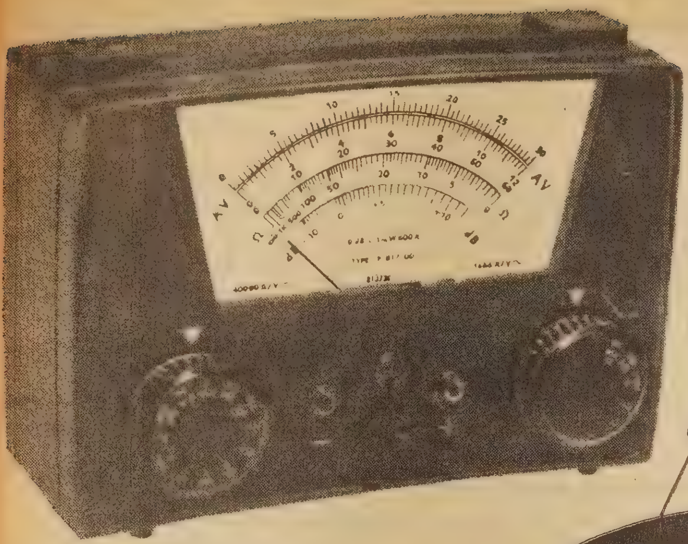


Fig. 8. Focal plane synchronisation, showing how the shutter slit should behave in relation to the light output "plateau." Incorrect adjustment means uneven illumination.



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SOME TYPICAL BATTERY-CAPACITOR CIRCUITS

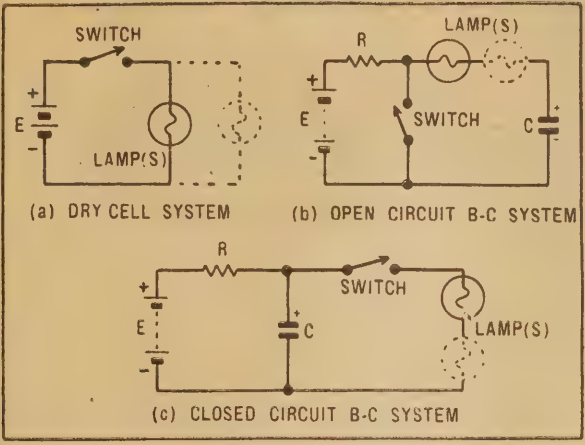

Fig. 9. Three typical circuits used for firing bulbs with synchronised shutters. Note the two "B-C" systems.

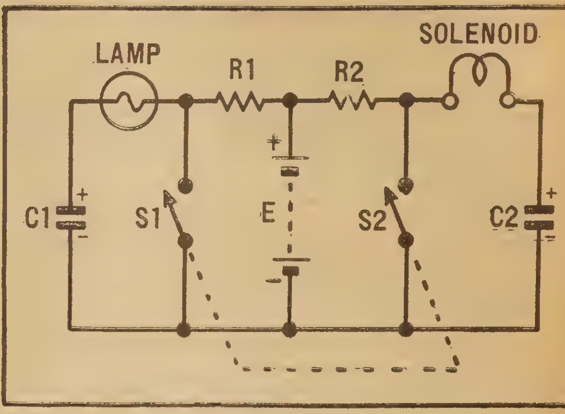

Fig. 10. Basic circuit providing "B-C" operation for both lamp and shutter solenoid. Note that delay for the shutter still has to be provided.

chroniser, the photographer should use care in removing and re-installing the cable release cord. If the tension or configuration of the cord is changed appreciably, the synchronisation might be affected.

Another type of mechanical photoflash synchroniser available is known as a "passive flash" unit. This is sketched in Fig. 6b. Here a tubular switch assembly screws into the cable release socket on either a self-cocking or pre-set shutter. When the switch plunger is depressed, a pair of contacts conencted to the flash gun close prior to the time that the shutter opens, again accomplishing the desired time relationships of Fig. 5.

4. Electrical Synchronisation. . . . The earliest type photoflash synchronisers employed electrical synchronisation. In these devices energy supplied by two or more "D" size dry cells is used to fire the photoflash lamp and to trip a preset shutter with an electrical solenoid. which is an electromagnet that draws down a plunger when current flows through a winding arranged around the plunger. A typical electrical synchroniser combination is sketched in Fig. 7

SOLENOID DELAY

To take a picture with the arrangement of Fig. 7, the photographer first cocks the pre-set shutter; then he presses the firing switch located on the flash gun barrel. Current flows through the flash bulb and through the solenoid. The solenoid plunger releases the shutter blades, and if the system is adjusted correctly, the shutter will be open at the time the light output is maximum.

Many Press photographers prefer electrical synchronisation, for it allows them to trip the shutter from the flash gun position. This is important if the flash gun is removed from the camera to obtain better modelling of the subject being photographed. One of the photographer's hands is occupied holding the camera—the other, which holds the flash gun, is then better able to press the switch to take the picture.

The solenoid method of tripping may be adapted to any pre-set shutter. The system has several shortcomings. however, which will be mentioned:

1. The system is "current sensitive." When small dry cells are used to trip the shutter, synchronism with the light peak depends largely on how much current the cells are capable of delivering. Synchronism in most equipment of this type becomes questionable when the battery fails to deliver 7 or 8 amperes. Consequently, little of the total available energy is taken from the battery before it is discarded.

2. When three or more lamps are fired at one time, synchronism of the shutter with all the light peaks is doubtful, particularly at high shutter speeds.

☆

These two tables will prove extremely valuable to photographers faced with the problem of firing multiple flash bulbs, or concerned with the design of B-C systems for shutter solenoids. Lamps and solenoids both operate with a high order of reliability, over a wide range of battery conditions, when a capacitor is used.

☆

3. Exact adjustment of the solenoid for best synchronisation of the shutter and lamps is difficult to check. Elaborate and expensive equipment is required to do a thorough job.

5. Focal plane synchronisation . . . the synchronism of focal plane shutters with photoflash lamps presents a special problem, because of the way the shutter exposes the film. As mentioned earlier, a slit in an opaque curtain traverses the unexposed film, exposing it a little at a time. This means that the light from the flash bulb should remain at essentially the same intensity while the slit travels the width of the picture; otherwise non-uniform exposure will result.

Fig. 8 shows the correct time relation of shutter slit travel and light curve for uniform film exposure. The curve shown is a reproduction of precise laboratory measurement of shutter travel and light output in a popular high quality 35mm camera with a synchronised flash attachment. The shutter speed setting was 1/200 second.

TABLE 1

MINIMUM CAPACITANCE VALUES FOR SERIES CONNECTED PHOTOFLASH LAMPS

No. of Lamps....	1	2	3	4	5	6	7	8	9	10	15	20
Minimum Voltage	3	6	9	12	15	18	21	24	27	30	45	60
Minimum Energy (watt-seconds)	.010	020	030	040	050	060	070	080	090	100	150	.200
Battery Voltage	Capacitance Values in Microfarads											
15	90	180	270	360	450	–		–	–	–	–	–
22.5	40	80	120	160	200	240	280	–	–	–	–	–
30	20	45	70	90	100	130	160	180	200	230	–	–
45	10	20	30	40	50	60	70	80	90	100	150	–
60	6	12	18	22	28	34	40	45	50	55	35	110
90	3	5	8	10	12	15	18	20	23	25	37	50

TABLE 2

MINIMUM CAPACITANCE VALUES TO TRIP A SHUTTER

(Based on stored energy = 0.1 watt-seconds)

Battery Voltage	15	22.5	30	45
Capacitance, Microfarads	900	400	225	100

As indicated in Fig. 8, the lamp circuit switch closes 14 milliseconds before the shutter slit starts to traverse the unexposed film area. When the slit starts to expose the film, the light intensity has reached a stable value, and it continues essentially constant until after the slit passes the lagging edge of film area. Thus uniform exposure will result.

All of the synchronised flash systems

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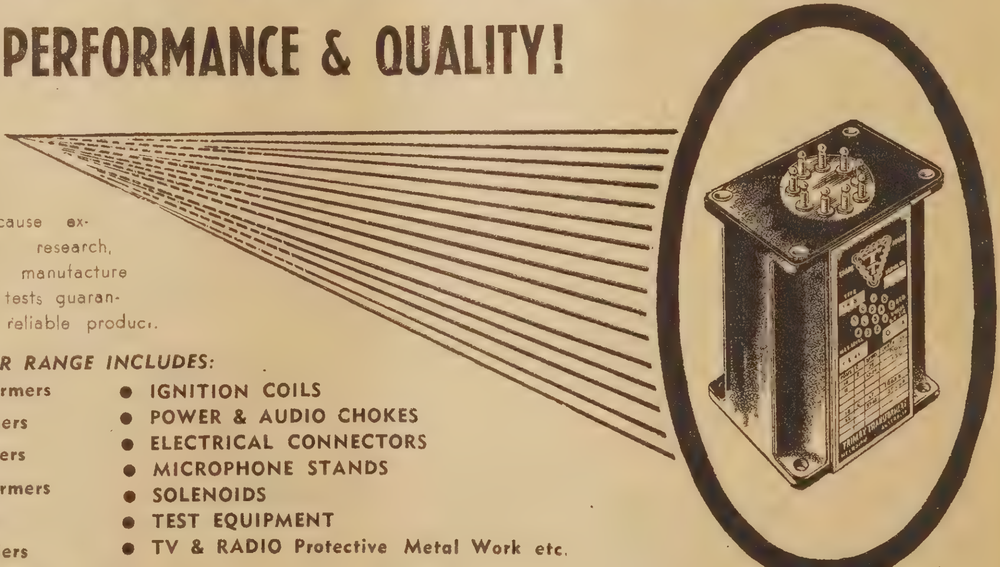

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described here present problems in that they are quite dependent upon the condition of the batteries used in them. Without exception, they demand batteries capable of delivering high current. At the same time photographers, particularly the amateur class, expect their batteries to last a long time—a year or more—on the shelf.

The problem is further complicated by the fact that photoflash synchronisers employing small dry cells are inherently inefficient. It has been shown that the usual solenoid type synchroniser is from ½ to 1 per cent efficient in the utilisation of the energy taken from the battery.

As dry cells age, their internal resistance increases. The available current then is reduced . . . ultimately to the point where they will not fire photoflash lamps. With increasing battery age, the time to burn out the photoflash lamp filament increases. In many synchronised shutters the time during which the switch contacts are closed becomes insufficient to burn out lamps with older batteries.

HEAVIER DRAIN

This problem is multiplied when the photographer atttempts to fire several lamps at once, as is frequently done in lighting areas or taking action pictures in colour. When using a low voltage supply, the coincidence of light peaks from all the lamps is questionable. If the A.C. power line is used, the photographer is faced with a shock hazard and a good chance that line fuses will blow.

The battery-capacitor flash system described in the following section provides a satisfactory solution to many of the flash problems that plagued photographers a few years ago.

The battery-capacitor (or "B-C," as it is commonly called) photoflash power supply differs from the early equipment through temporary storage of electrical energy in a capacitor, rather than transferring current directly from the battery to the photoflash lamp.

In practice, the current need not exceed .01 ampere to charge the capacitor in two seconds or less. The B-C system is therefore much less sensitive to battery condition than systems employing small dry cells, where the energy flows directly from the battery into the flashlamp.

CHARGING TIME

When the "B" battery ages, the time required to charge the capacitor increases, but it will ultimately be fully charged even with batteries one or two years' old. The charging time determines how soon the battery should be replaced. At the instant of flashing, the energy flows from the capacitor into the photoflash lamp in a very rapid surge.

A simple B-C power supply is shown in Fig. 9b Here inserting the lamp in the socket closes the capacitor charging circuit, but no damage will be done to the lamp filament for the peak charging current is limited to a safe value by resistance R, usually from 2000 to 3000 ohms. The capacitor charges in two seconds or less.

Closure of the switch causes a surge of current to flow through the lamp filament, burning it out in approximately one milli-second and starting the flash reaction. If additional lamps are to be fired, they should be connected in series

(Continued on Page 111)

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	Neat P.58H	39	0	0
	Lenco GL.55	30	0	0
	Thorens TD124	76	0	0
Pickups:	Torens BL104 (also available as complete unit with remote control)	8	9	8
	Goldring G-60	8	10	0
	Ortofon: Full stocks available, "A," "C," and Sterco heads, 12in, 16in and Stereo arms.			
Amplifiers:	Leak TL12 plus	57	6	1
	Leak TL25 plus	76	13	0
	Leak TL50 plus	106	2	0
	Leak Varislope III Pre-amp	48	6	5
	Leak 1 Plus Pre-amp	38	4	5
	R.C.A. Orthophonic	139	10	0
	Quad II Complete	115	5	0
	Verdik c/w 1 v Pre-amp	52	10	6
	Verdik c/w 2 v Pre-amp	59	10	0

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BSR HF8 Player	13	5	0
BSR UA8 Changer	20	10	0
Dual 295 Player	18	10	0
Dual 1004-T-12 Auto **Player**	28	10	0
Dual 1004 Changer	32	8	6
Dual 1005 Changer	37	9	6
Thorens CBA83N Auto. Player	44	17	6
Thorens CD43N Auto. Changer	59	10	0
Collaro 4T-200 Transcription	31	2	6

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Wharfedale:	W15/FS	44	3	7
	Super 12FS/AL	44	3	7
	W.12/FS	28	1	9
	W.10/FSB	25	5	6
	Golden 10in	17	2	9
	10in Bronze	11	0	0
	Column 8/145	15	10	6
	Super 8FS/AL	13	12	4
	Super 8FS	13	0	3
	Super 3 Tweeter	13	12	4
Goodmans:	Axiom 300	29	1	9
	Audiom 60	25	17	8
	Midax	21	18	3
	Grampian: 1255/15	20	6	3
	Rola: 12UX Hi-Fi	28	19	5

TWEETERS

Goodmans:	Trebax	12	5	3
Ibbott	360 deg	14	14	0
AE Electrostatic:	LSH.75		16	3
	LSH.518	1	2	6
	LSH.100	1	7	6

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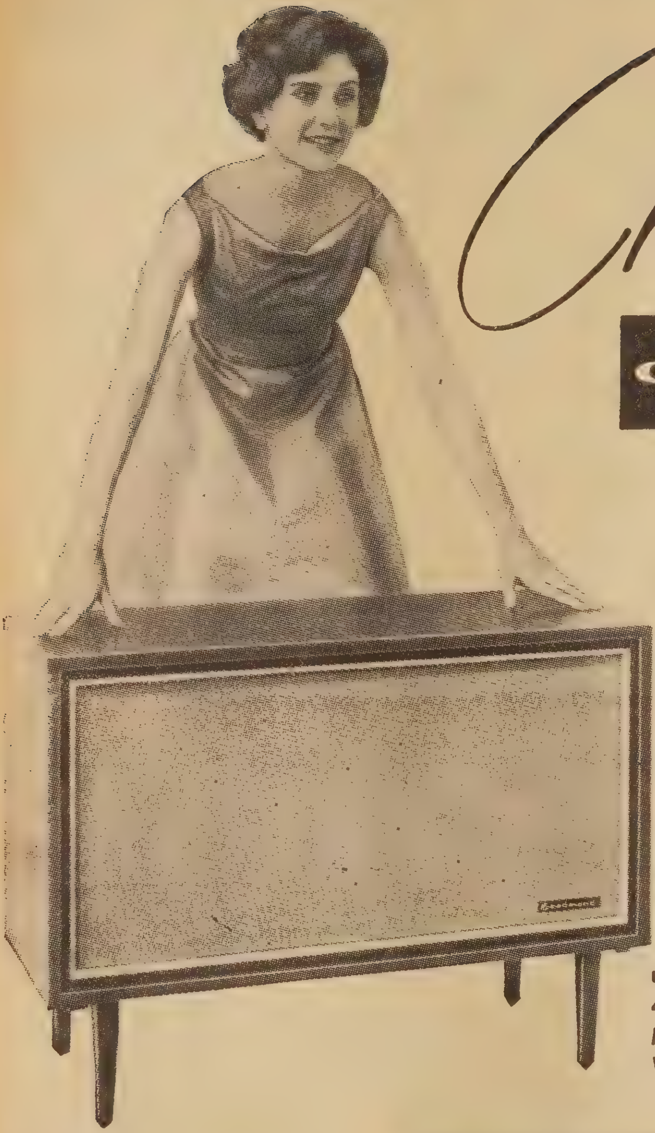
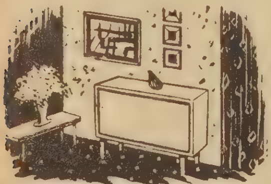


MODEL 15/4

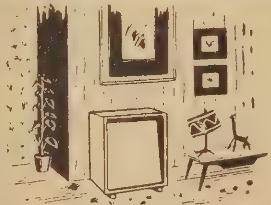
4-way, quadruple radiator Full-range High Fidelity Loudspeaker System, Walnut finish.

Attractive range of enclosures . . . .



MODEL 15/4 *(Illustrated)*

This 4-way quadruple radiator Full-range High Fidelity Loudspeaker System is characterised by exceptional smoothness. Entirely new Enclosure design, wax polished in selected Walnut veneers.

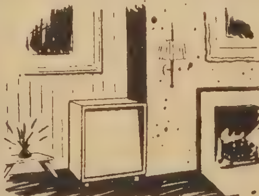


SHERWOOD 1

A balanced 2-Radiator SINGLE Unit Full-Range High Fidelity System. The Enclosure is wax polished in selected Walnut veneers.

SHERWOOD 2

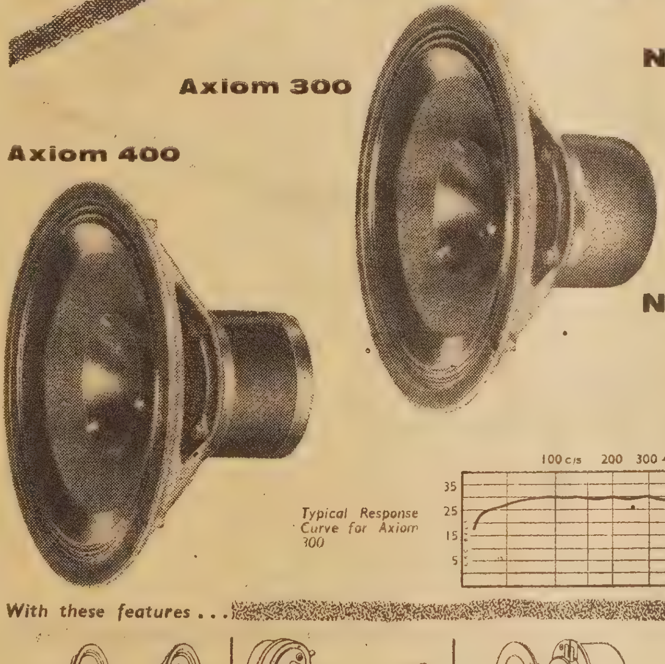
The SHERWOOD 2 is a balanced 3-Radiator Twin Unit Full-Range High Fidelity System, Enclosure as SHERWOOD 1.

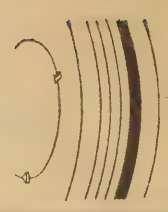


SHERWOOD 3

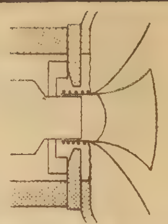
Balanced 3-way Full-Range, 30 c/s to 16,000 c/s, High Fidelity Loudspeaker System in Sherwood Enclosure. Overall range divided between three specially developed precision built units.

Fidelity

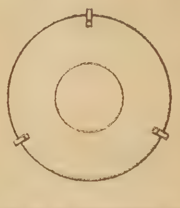




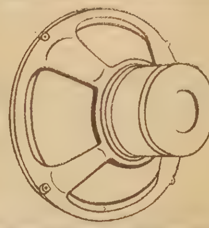
NEW **PLASTIC TREATED BASS DIAPHRAGM SUSPENSION** provides correct termination to eliminate standing waves and edge resonances.



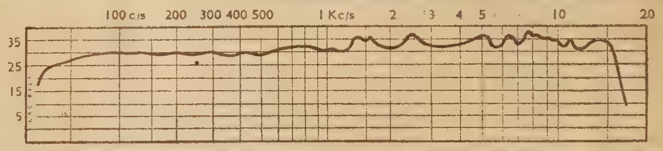
NEW **LONG ALUMINIUM VOICE COIL** combines low mass for extended high frequency operation with constant "turns in the gap" at high bass amplitude.



NEW **FOAM TERMINATED TWEETER CONE** for prevention of spurious resonances.



NEW **CHASSIS DESIGN** gives maximum open area combined with immense rigidity and freedom from ringing.



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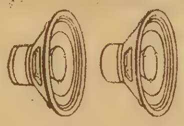
With these features . . .



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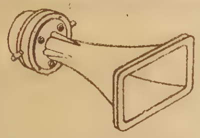
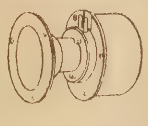
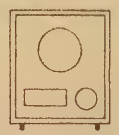
Superb transient response, achieved by use of powerful magnets, correct loading, and precisely controlled low resonance with plastic suspension



UNDISTORTED MID-RANGE
Achieved by all FOUR Systems In Sherwood 1 and 2 by mechanical crossover and Auxiliary Diaphragm; in Sherwood 3 and the 15/4 by electrical crossovers in conjunction with latest Mid-Range pressure driven Horn Loaded Unit



UNDISTORTED TREBLE
Cleanly radiated high notes, by virtue of newly developed twin cone design in Sherwood 1. Sherwood 2 and 3 both employ tailored High Frequency Pressure Driven Horn loaded units. The new 15/4 system utilizes two such units positioned to give maximum coverage



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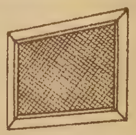

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6602

Here's your answer, Tom!

Tom's queries for this month were quite varied, ranging from audio to electrical appliances. Of particular interest was a query seeking an explanation for the term "decibel." We have endeavoured to keep the answer in general terms and, as set out below, it should prove to be of general interest.

BEFORE proceeding with our queries for this month we wish to acknowledge a correspondent, R.F.S., of Camberwell, Vic., who has brought to our attention an error which occurred in an answer to Tom in the February issue.

The answer was to a question on a doublet aerial and between the fourth and fifth lines the word "half" should appear to make the text read, "95 per cent of the half-wavelength at which it is supposed to operate."

★ ★ ★

What is a decibel and how much power does it indicate?

First and foremost, Tom, we must emphasise that the decibel is not, in itself, an absolute unit like a pound weight or an inch of length. It is simply an expression of a ratio, like 2 is to 1, or 28 is to 3, 5 is to 17, or any other pair of figures you like to think of.

The idea relates basically to the characteristics of the human ear and its response to sound levels of different intensity.

If an amplifier system is producing a power output of, say, 1 watt and the output is increased to 5 watts, the audience will notice a certain increase in loudness. If it is now increased by a further 4 watts to 9, the increase will not be anything like as evident.

A still further step from 9 to 13 would probably pass unnoticed.

The point behind this is that the ear does not respond to simple arithmetic changes in acoustic power level. It responds more on a ratio basis. Thus an increase from 1 to 5 watts would be judged to be about equivalent to a subsequent change from 5 to 25 — in each case a ratio of about 5 times.

In itself, this is a most important characteristic because it means that the ear can be very sensitive to low-level sounds, but, at high levels, increasingly large increments of sound power can be accommodated without ill-effect.

In seeking to evaluate the response of the ear it became evident that the difference in apparent loudness between sounds of different acoustic power could be expressed very conveniently in terms of the logarithm of the ratio.

This sound-level ratio, expressed as a logarithm, came to be known as the "Bel." Because it was rather too large a figure for convenient use, it has been displaced by the "decibel," which is simply one-tenth of a Bel.

By resorting to the use of decibels we have a figure which looks and handles like a simple arithmetic quantity, but which is, by its nature, the expression of a ratio.

It is convenient, too, because a decibel can be regarded, roughly, as a very small change in sound level and one soon gets to appreciate the approximate order of change in all kinds of audio equipment represented by so many decibels "up" or "down."

By way of example, a change in audio level from 1 to 2 watts represents a simple ratio of 2 times. But the logarithm of 2 is near enough to 0.3, so that the change would represent 0.3 Bel or 3 decibels.

As far as the listener is concerned, a change of 3 decibels is quite a small one and, for most practical purposes, can be considered as the smallest change which the casual listener can notice or appreciate.

☆

"Are you having any trouble with your TV, Hester?"

(—TV Times)

☆

There would thus be little point in making a circuit change which resulted in a power variation of only 1 decibel, irrespective of what power level is involved. However, a number of minor changes, adding up to a total of 3 decibels or more, would be significant.

In other words, Tom, once the basic idea of the decibel is grasped, as a ratio related to the sensation of loudness, it is much more explicit and much easier to use than statements of actual power level or clumsy numerical ratios.

All through, we have presented the Bel or decibel as simply an expression of a power ratio. However, for special purposes, it has acquired the stature of an actual unit of power.

This came about because telephone and radio engineers and others found themselves working commonly with signals of a certain power level, being concerned by the number of decibels the signal might vary above and below that level. To simplify their work, they have attributed certain (and various) power levels to "0 decibels" and proceeded thereafter to specify signals as so many decibels, plus or minus.

Unfortunately, these arbitrary reference levels have not all been the same, which has led to a good deal of confusion.

The decibel has also come to be "misused" in another way. The power in a circuit is dependent on the voltage across the circuit and partly on the impedance of the circuit. The relevant formulas says:

Power equals Volts squared times Resistance.

If the voltage in a circuit is doubled, the power is increased by 2 squared, equals 4 times. Expressed as a logarithm, this is about 0.6, or 0.6 Bel or 6 decibels. Thus, an expression results that signal voltage ratios can be expressed as decibels by multiplying the log. of the ratio by 20.

Strictly speaking, this relationship holds true only in a given circuit or in circuits of identical impedance. However, in a great deal of radio work, the impedance of a circuit is of lesser importance than the voltage. It is, therefore, quite commonplace to express figures of voltage gain, frequency response deviation, etc., as so many decibels plus or minus, without reference to impedance.

While strictly incorrect, the usage is very firmly established in radio circles

How can DC voltages be doubled or increased by means of capacitors and a rectifier in a voltage doubler

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GRAIN ORIENTED
ULTRA-LINEAR OUTPUT TRANSFORMER

TYPE OP387

This new transformer, employing oriented grain steel laminations, gives superlative results in high fidelity amplifiers such as the ultra-linear version of the "Mullard 5-10" and the "Playmaster 10 watt Stereo Amplifier" (Jan. 1959 issue of R. TV & H.).

SPECIFICATION

PRIM. IMP.	8000 ohms P.P.
SCREEN TAPS	18.5 % of plate imp.
SEC. IMP	OP387-15 — 15 or 3.75 ohms OP387-8.4 — 8.4 or 2.1 ohms
NOM. POWER RATING	12 watts
FREQ. RESPONSE (Attainable)	20-100,000 c.p.s. plus or minus 1 db. (at 1 watt)
POWER RESPONSE (Attainable)	30-50,000 c.p.s. plus or minus 1 db. (at 10 watts)
PRIM. D.C. RESIS	90 ohms (each half)
MAX. PRIM. D.C.	80mA (each half)
SEC. D.C. RESIS.	Less than 6% of sec. imp.
PRIM. INDUCTANCE (10V 50 c.p.s. plus 5 mA unbalance)	160 henries
LEAKAGE INDUCTANCE	7 millihenries
PRIM. FUND. RESONANCE	140 Kc.
INSERTION LOSS	LESS THAN 1 db.

Fitted with vertical mounting covers finished in standard FERGUSON Silver-Grey Hammertone, with laminations in black. Packed in strong carton with complete data sheet.

STEREO POWER TRANSFORMER

TYPE PF1412

As specified for the "Playmaster 10W Stereo Amplifier" (R.TV & H., Jan. 1959) to supply amplifier and tuner, etc.

PRIMARY	230, 240V	50 c.p.s
H.T. SEC.	300-0-300V	200mA
L.T. SEC.	6.3V—3A, 6.3V—3.5A C.T., 5V-3A	

Use FERGUSON choke type F1-285

OC 16 TRANSISTOR TRANSFORMERS

TYPE TRD 117 TYPE TRS 105

Designed for use in the amplifier described in Philips Miniwatt Journal Vol. 1, No. 2.

TRD 117	TRS 105
PRIM.—420 ohms C.T. SEC. — 105 ohms C.T.	PRIM. — 33 ohms C.T SEC. — 15 ohms

Two amplifiers are described by Philips, for 500 milliwatts and 10 watts output. The correct FERGUSON transformers for each amplifier are listed below.

500 mW.	10 Watts
T1—TRD 108	T1—TRD 108
T2—TRS 107	T3—TRD 117
	T4—TRS 105

FILAMENT BOOST TRANSFORMER

FOR TV PICTURE TUBES

TYPE PF 1387

Designed to provide a "boost" voltage to a TV picture tube heater towards the end of tube life, thus increasing the cathode emission and increasing usable picture tube life.

The transformer is an auto type and connects between the 6.3V heater line and the picture tube heater.

PRIM.—6.3V 50 c.p.s
SEC.—7V, 8V or 9V-1A

Manufactured by

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FERGUSON LANE, CHATSWOOD, N.S.W. JA8491

circuit? It appears impossible, yet it is done.

We can easily understand your difficulty, Tom, for at first glance it would appear to be so. However, it is not correct to say that DC voltage can be doubled by means of a rectifier and capacitors. An AC supply is required, and, with the aid of the doubler circuit, the rectified DC output may be made as high as twice the peak value of the AC input.

The action is not difficult to follow, but it will show that it is necessary to have an AC source to achieve the result.

Looking at the circuit, which is reproduced, it is not difficult to follow that, on the positive half-cycle of the AC input, when the top end of the transformer secondary is positive the top diode conducts and feeds a positive charge to the top plate of the top capacitor, building a positive charge across it.

On the second half of the cycle the bottom end of the transformer secondary becomes positive and the lower diode conducts so that a positive charge is fed to the top plate of the lower capacitor.

As long as no current is drawn from the capacitors each is capable of charging up to the peak value of the AC input and the total voltage across them will be the sum of the peak voltages.

If current is drawn from them the voltage will drop by an amount which depends on the load current and the size of the capacitors.

If conventional rectifiers are used they cannot have a common cathode and must be supplied by separate heater windings. For this reason metal rectifiers are particularly suited for use in this type of circuit.

On the other hand, the advantage of a doubler circuit is that the transformer may be designed with insulation suitable for only half the voltage it would normally be called on to supply if a conventional rectifier and filter system were used.

Voltage doubling circuits are also used very commonly in "transformerless" equipment operating from 110-volt AC mains, as in the U.S. The circuit provides 200 volts more of rectified and filtered DC for the valve plates.

* * *

Why are 240-volt jugs, toasters and irons marked AC only? These appliances use a length of resistance wire for their elements and I can see no reason why they cannot be operated from 240 volts DC as well.

Not all AC appliances are unsuitable for DC operation, Tom. In the case of irons, toasters and other heating appliances only the automatic units which depend on thermostats and other such devices for their operation are unsuitable for DC.

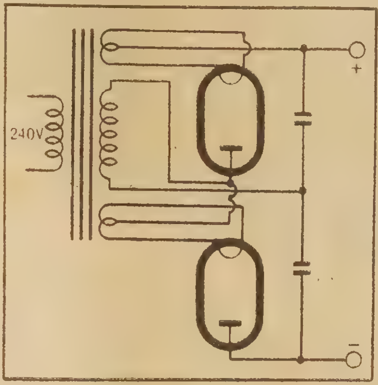
The reason for the above is that in a DC circuit any contacts making or breaking the circuit may strike an arc. When the contacts are opening, the arc, once struck, can be maintained for an appreciable length of time.

This treatment will eventually destroy the light contacts designed for an AC circuit.

To enable such appliances to be used reliably on DC special contacts would be required or some method of quenching the arc. This presents a serious manufacturing problem, added to which there is not much demand in Australia for DC mains appliances.

In an AC circuit, on the other hand, any arc that forms between contacts tends to be self-quenching. This is due to the fact that alternating current passes through zero twice each cycle or 100 times per second. Any arc which occurs on opening a pair of contacts, therefore, tends to extinguish less than one-hundredth of a second later.

This being so, contacts controlling an AC circuit can be relatively light and separated by only a small distance when open.



Circuit of the voltage doubler discussed in the text.

Electric jugs using an open type element are unsuitable for DC operation because of the electrolytic action which will take place due to impurities in the water. This rapidly destroys the element.

Immersion heaters, which are totally enclosed, are suitable for either AC or DC circuits. Jugs with completely enclosed elements are also made for DC use.

* * *

If transistors are as good as they're supposed to be, why aren't they being used in amplifiers and TV sets instead of valves?

You ask this, Tom, almost as if you're trying to pick a fight.

In the first place, no one seriously regards transistors as anything like perfect. They have serious limitations and fall short of the ultimate performance of valves in many respects.

However, they also have important advantages, even at this early stage in their development and these advantages are so vital that they dictate their use for certain classes of equipment.

For example, their economy in battery drain is a tremendous advantage for battery powered equipment. Again, in computing devices, their use obviates the tremendous heat problem posed by masses of valves.

In ordinary amplifiers and TV sets, neither factor is vital, and it is simply easier and cheaper to use valves.

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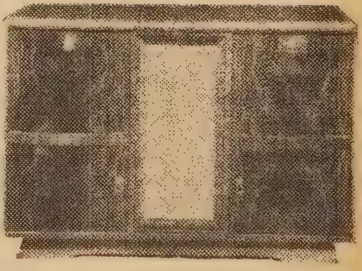

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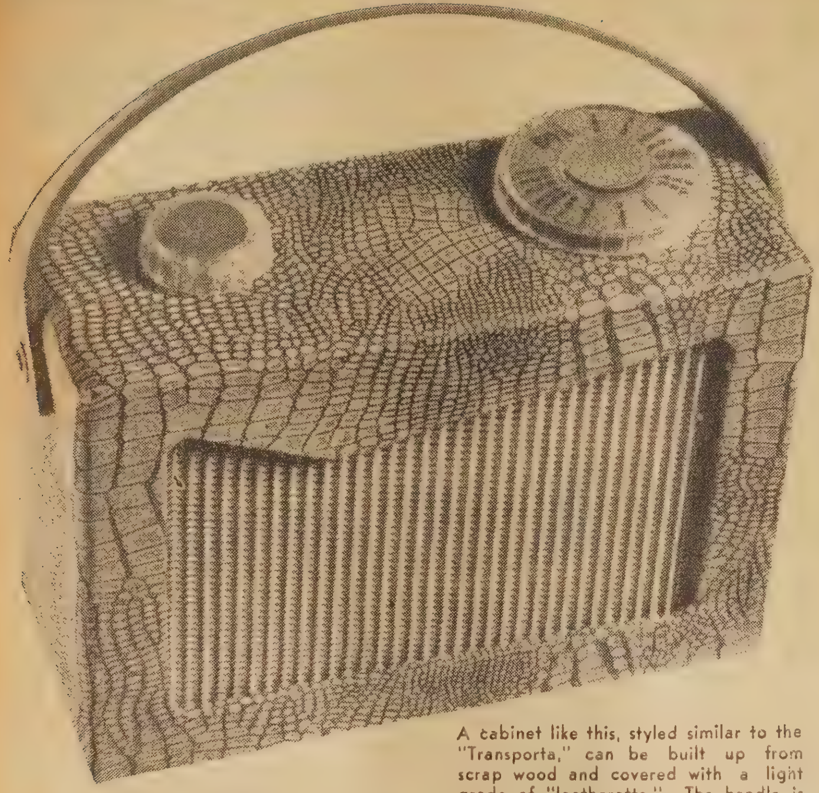


A cabinet like this, styled similar to the "Transporta," can be built up from scrap wood and covered with a light grade of "leatherette." The handle is cut from ordinary leather strap.

A Four-Transistor Superhet

This may well be the simplest all-transistor superhet receiver ever described for home construction. You may care to regard it as an experimental project or build it up as a complete self-contained portable, capable of playing all local stations with ease on its ferrite rod aerial.

by Neville Williams

THE basic idea behind this set will be obvious enough to anyone who has followed our more recent articles on home-constructed transistor receivers.

First of these was the description in the August, 1958, issue of the "Transporta Six," followed in February, 1959, by the "Transporta Seven." Both these were full-scale superhets and the latter in particular has proved very effective as a general-purpose portable, with excellent range, audio output and operating economy.

SIMPLE RECEIVERS

At the other end of the scale, we featured a series of simple regenerative receivers in the December, January and March, 1959, issues, intended for beginners or those who wanted to become familiar with transistors, without laying out the cost of a full-scale portable.

The three-transistor mantel receiver in the March issue proved to be a particularly effective small set, giving an excellent account of itself with a few feet of aerial. It featured a tuning coil wound on a ferrite ring (a toroid), a regenerative transistor detector, followed by a directly coupled two-stage audio system.

As with any regenerative arrangement, the ultimate performance of the set depended largely on proper use of the reaction control potentiometer, which naturally needed some readjustment as the main tuning capacitor was moved from one station position to another.

Out of all this came a natural speculation as to a possible simple superhet arrangement, using fixed regeneration at intermediate frequency and the same two-stage audio system. And so to our latest circuit, which ultimately worked out even better than we had hoped.

Using a standard ferrite rod aerial and with the regeneration control pre-set to a point just below oscillation, we had not the slightest difficulty in tuning all local stations with gain to spare. Only for distant stations would it have been necessary to resort to a supplementary primary winding with an external aerial and earth.

In terms of audio output, there was more than sufficient volume for ordinary listening in a quiet room. This may seem a rather extravagant claim for a nominal 40 or 50 milliwatts of power output but it is quite factual.

Much depends, of course, on the sensitivity of the speaker and we suggest nothing less than the 4-5F type or its equivalent, to make best use of the available power. Another point is that the bass response has been limited deliberately and this, together with the rather accommodating overload characteristic of the amplifier, allows it to be pushed fairly hard, without making unpleasant noises.

FREQUENCY CHANGER

Looking at the circuit, the first stage uses a 2N252 transistor as a self-oscillating mixer, with constants exactly as for the "Transporta" superhets. This changes all incoming signals to an intermediate frequency of 455 Kc.

In a normal superhet, the frequency changer would be followed by one or two I.F. amplifier stages feeding into a diode detector. In this set, there are no I.F. amplifier stages, as such, and no conventional I.F. transformers.

Instead, the output from the collector of the mixer stage passes to a winding on a ferrite ring, tuned by a 425 pF 5 pc. capacitor—the type normally used as a padder. The number of turns has to be manipulated so that the winding is resonant as near as possible to 455 Kc.

It is, in fact, a highly efficient home-made I.F. transformer.

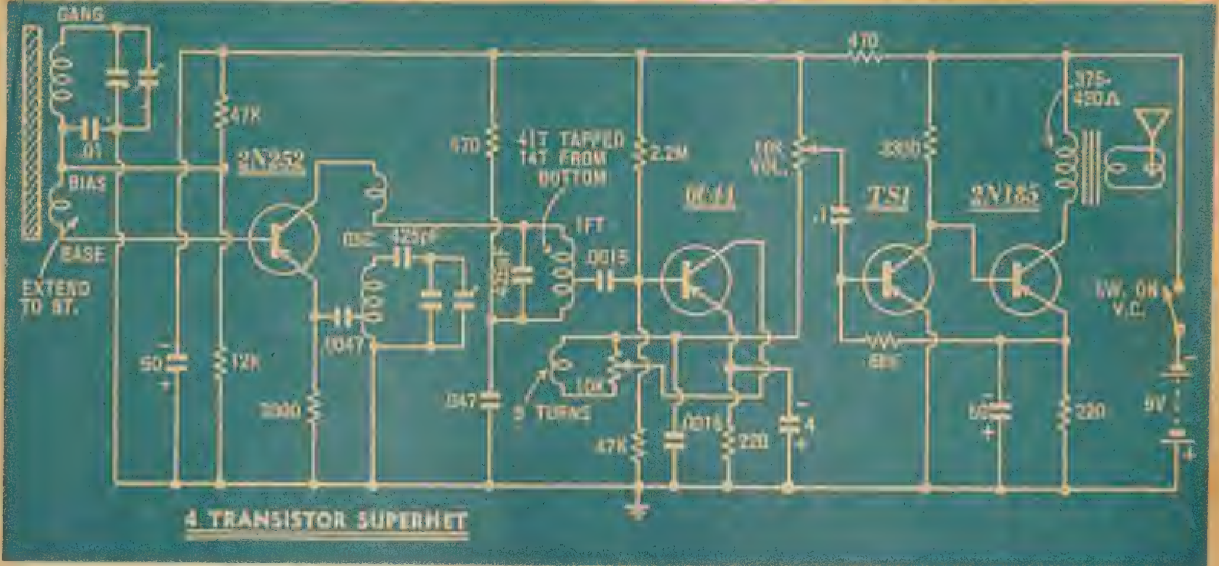
From a tapping on the winding, the incoming signal (now at 455 Kc) is fed to the base of an OC44 transistor functioning as a regenerative detector and with all the inherent gain that such devices have. We have specified the OC44 because it has proved particularly suited to this circuit.

REGENERATION

Regeneration is secured by a three-turn winding on the ferrite ring and therefore coupled inductively to the input circuit. Collector signal current is passed through this reaction winding and, provided it is connected the right way round into circuit, positive feedback results, sufficient to bring the detector up to and even beyond the point of oscillation.

Actual control of regeneration is obtained by a 10,000 ohm potentiometer wired across the reaction winding and

SUPERHET "FRONT-END" AND REGENERATIVE DETECTOR



Here is a circuit that you may care to experiment with or alternatively build up as a simple portable. It uses a frequency changer, a regenerative detector operating at 455Kc., and a simple directly-coupled two-stage audio amplifier.

with the collector taken to the tapping. Optimum gain and sensitivity is secured with the control set to bring the detector to just short of the oscillation point.

The advantage of this particular circuit arrangement lies in the fact that the detector operates always at the one frequency and there is therefore no need to re-set the control each time the receiver is tuned to a different station.

In actual fact, the ultimate setting of the reaction potentiometer is affected slightly by receiver tuning, by alignment procedures and, of course, by the exact battery voltage. In practice, however, it is not difficult to find a setting which at the one time ensures adequate stability and near-to-optimum performance at any setting of the tuning dial.

You may notice that we have altered slightly the wiring of the reaction potentiometer from the earlier three-transistor circuit to give a smoother control action. The potentiometer should ideally be a miniature carbon type, with a linear element, designed for tab mounting and for adjustment with a screwdriver.

DETECTOR

The DC conditions of the detector are the same as for the earlier circuit but we have added a bypass across the emitter bias resistor. This appears to confer a minor advantage in respect to overall gain, though it is difficult to assess just how much, by reason of its simultaneous effect on the reaction circuit.

To control and limit the gain on strong signals, we have specified a conventional audio volume control between the detector and the first audio stage. This can be a 10,000-ohm potentiometer, as for the "Transporta" receivers, with an attached off-on switch and preferably a "low hop-on" resistance element.

Behind the design of the audio amplifier there is quite a story.

Briefly, and among other things, transistors are noted for their sensitivity to heat and for the ease with which they can be damaged by electrical overload. Both factors have to be considered very carefully when designing any circuit using transistors.

It is not sufficient merely to apply the necessary forward bias to secure optimum gain, optimum output or maximum permissible collector dissipation. Quite apart from possible variation between individual transistors, collector current is likely to rise sharply with any increase in ambient temperature, upsetting operation of the circuit and, in some cases, damaging the transistor by reason of excessive collector current.

To compensate temperature effects and to secure more uniform behaviour, most transistor stages involve resistor networks so arranged that any increase in collector current is substantially offset by an automatic decrease in the forward bias. Inevitably, this multiplies the number of resistors and capacitors required in the overall circuit.

In the audio amplifier, as shown, the temperature coefficients of the TS1 and 2N185 are deliberately made inter-dependent by the direct coupling. One tends to compensate the other, allowing parts to be eliminated which would otherwise be required.

Bias for the base of the TS1 comes from the emitter of the 2N185. The TS1 draws collector current through its 3,300 ohm load and operates, in practice, with about minus 3.5 volts on the collector.

This same potential is present on the base of the 2N185, its effective bias being the difference between this and the voltage developed across its own 220-ohm emitter bias resistor.

Dissipation is not a problem in the TS1, which operates purely as a resistance-coupled amplifier. It has to be carefully watched however in the 2N185, where the bias must be set critically to obtain maximum output and lowest distortion, without transgressing permissible collector dissipation.

In this circuit, any rise in average 2N185 collector current will produce extra voltage drop across the 220-ohm

PARTS LIST

1 Cabinet, internal clearance, measurements 8 3/8 x 6 x 3 inches.
1 chassis, 8¼ x 5½, with a 4 7/8 x 2-inch fold-over.
1 loopstick aerial. (See text re modification).
1 5 x 4-inch high sensitivity speaker.
1 output transformer, 375 to 420 ohm load.
1 2-gang miniature (Roblan), 420 approx. pF.
1 ¼ inch extension shaft for above.
2 50 pF trimmers.
1 oscillator coil, as for "Transporta."
1 Ferrite ring (Ducon F4021).
1 calibrated tuning knob.
1 volume control knob.
1 piece of bakelite or fibre for punching and rivets to suit.

TRANSISTORS

1 2N252, 1 OC44, 1 TS1, 1 2N185.

CAPACITORS

2 50 mfd 12 volt electrolytics.
1 4 mfd 3 or 6 volt electrolytic.
1 .1 mfd 100 volt paper.
1 .047 mfd 100 volt paper.
1 .01 mfd 100 volt paper.
2 .0047 mfd 100 volt paper or ceramic.
2 425 pF mica, close tolerance.
2 0015 mfd paper or ceramic.

RESISTORS. All ½ watt.

1 10K potentiometer with switch, low hop-on resistance preferred.
1 10K potentiometer, tab mounting with screwdriver adjustment.
1 2.2M, 1 68K, 2 47K.
1 12K, 2 3300 ohm, 2 470 ohm.
2 220 ohm.

SUNDRIES

Hookup wire, tinned copper wire, spaghetti, solder, 9-volt battery type, 276-P, nuts and bolts, battery plug, length of 26 B. and S. enamel wire for IF transformer.

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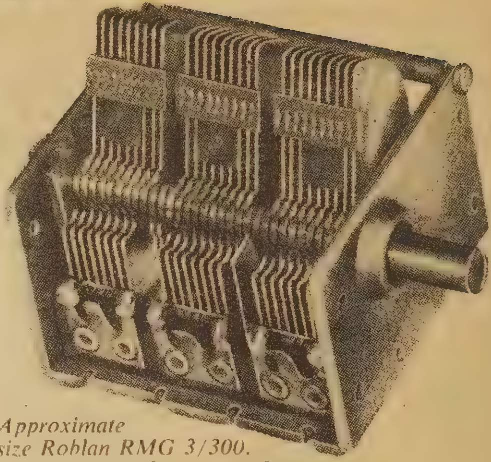

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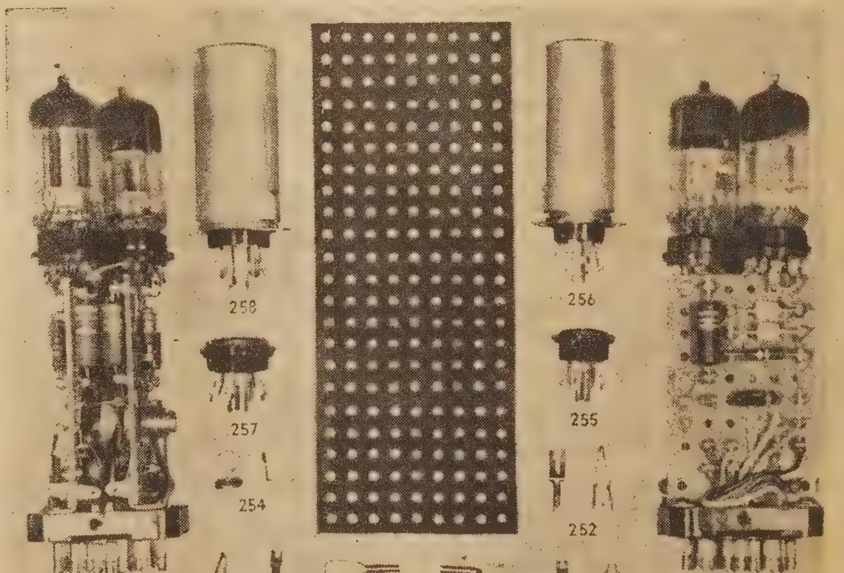

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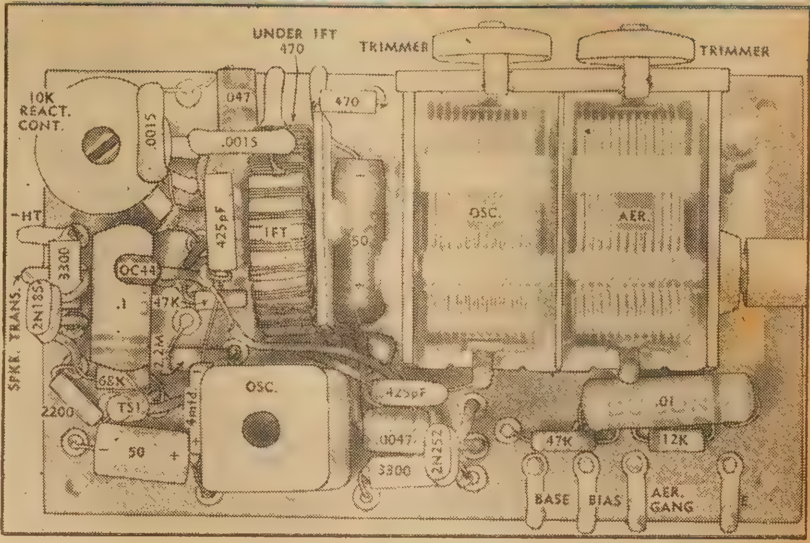


This assembly board contains the entire circuitry of the receiver, except for the switch-pot, and the loudspeaker output transformer. Most of the components can be identified readily enough.

emitter bias resistor. This means additional negative bias at the base of the TS1, higher collector current and a consequent shift in TS1 collector and 2N185 base voltage towards earth. This effectively counteracts and limits the degree by which the 2N185 collector current can actually alter.

In practice, the conditions which obtain under high temperature limit the power output somewhat but remain within the collector dissipation limits of the output transistor.

OTHER TRANSISTORS

The circuit, as it stands, has been fully proven only with the combination of a TS1 and a 2N185. It may or may not suit other individual transistor types and, if you must use such, rather than take the risk of unsatisfactory behaviour, it may be better to use a conventional resistance-capacitance coupled circuit. (See page 31, March 1959 issue.)

For correct operation, collector load for the 2N185 should be between 375 and 420m ohms and the obvious course is to use the type of transformer designed for the original "Transporta" receivers, ignoring the centre-tap.

It would be quite useless trying to obtain adequate power with an ordinary loudspeaker output transformer designed for use with valves and having a nominal impedance of several thousand ohms.

As we stated earlier, the set can be built up in almost any physical form that happens to suit your requirements, layout not being particularly critical. In our own case, we made it up as an abbreviated version of the "Transporta" receivers and others may care to follow suit.

The major components are assembled on a simple baseplate, the dimensions of which are given in an accompanying diagram.

The speaker mounts near the centre over an appropriately shaped hole. Try to obtain one with a transformer bracket attached, otherwise you will have to devise a couple of angle brackets, as we did, to hold the transformer in the equivalent position.

The space to one side of the speaker is occupied by the battery and by the switch-pot., while the receiver proper is concentrated on an assembly board on the other side. A cut-out gives access to the underside of this board, so that everything is readily accessible.

SUPPORT BRACKETS

To support the loopstick, a couple of brackets were fashioned from scrap aluminium. They can be shaped like an over-sized solder lug, 1¾ inches long, and with room in the large end to accommodate a 3/8-inch I.D. grommet.

The stem portion can be twisted through 90 degrees and bent over so that, when bolted to the turned-up lip, the brackets will support the rod so that it passes just in front of the tuning gang and clear of the arc described by the rotor plates.

Note that the bracket ends must be cut through so that they do not form a closed circuit loop around the ferrite rod. A shortened turn round the rod in any shape or form will reduce inductance and possibly signal pickup.

As a point of interest, we made some careful observations with a commercial loopstick and aerial coil to discover what seemed to be the best compromise between gain and selectivity for a small set, as determined by the number of turns on the base winding.

As supplied, the coil had five turns on the base winding, but we found it advantageous to increase this to eight by simply winding the trailing end of the wire three times more around the former and in the same direction. The extra turns were held in place with a spot of wax and the lead extended as necessary with a short scrap of fine wire.

To duplicate our original layout for the receiver proper, you will need a scrap of 1/16-inch bakelite, fibre board or something to serve the same purpose. If you make the board 2-15/16 inches wide by 5¼ inches long, it will give you slightly more room to work than on our prototype.

By drilling suitable holes, all major components can be mounted directly on the board. Support points for small components can be provided by drilling 1/16 or 5/64-inch holes and inserting tiny tubular rivets. The components are then mounted above the board and wires underneath, similar to printed wiring practice.

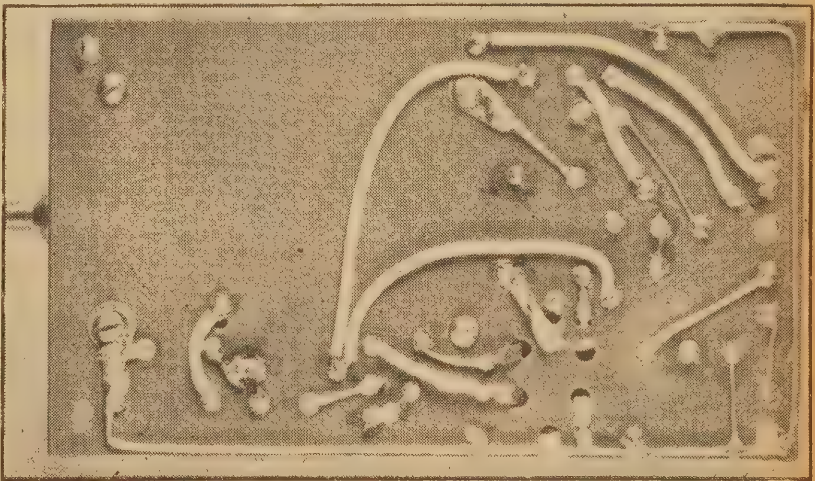
External connections are effected by means of rivet-type solder lugs, arranged around the edge of the board.

Rather than try to mention every part, we have shown top and underside views of the assembly board, which should serve as a good general guide.

TRANSISTOR LEADS

We suggest that you leave the transistor leads at full length, covering them with spaghetti to prevent them shorting. This will preserve them for possible future use and, provided you just spot them into circuit, will minimise the risk of sufficient heat being transferred to the transistor to cause damage.

It is wise also to mount the small



Here is the underside wiring of the assembly board. Cross-overs have been avoided so that it would not be a very difficult matter to evolve a printed board, if any of our advertisers see fit to do so.

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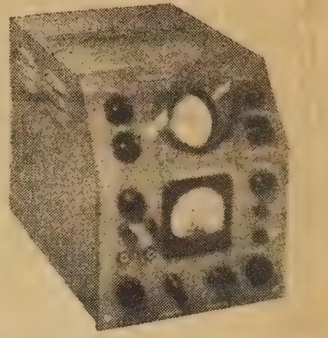

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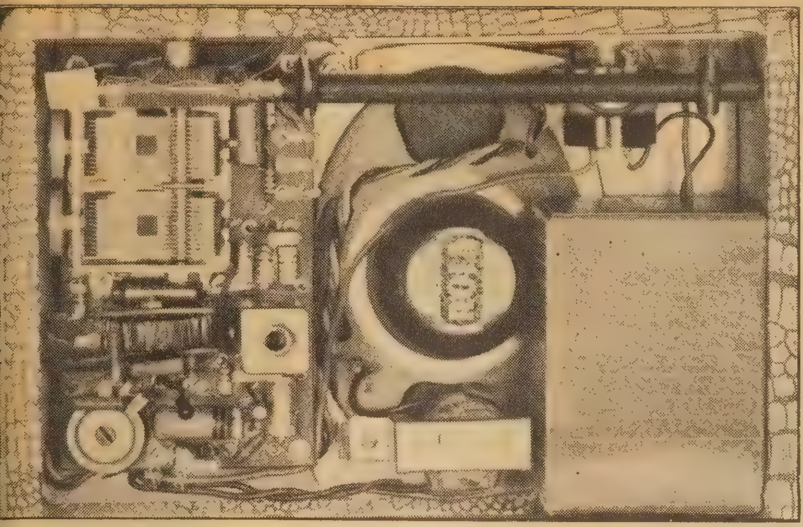


A view inside the cabinet of the set. Although not clear from the photograph, the receiver proper, the speaker and potentiometer all mount on a metal baseplate, and slip in and out of the cabinet as a unit.

wiring components a little away from the board so that there will be 3/8 inch or more of lead between the end of the component and the hot soldered joint. This amount of wire is not significant at broadcast frequencies.

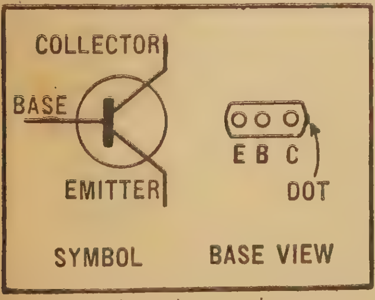
A point of note is that we have specified a padder value of 425pF as against 390pF on the earlier circuits. One reason for this is that low tolerance 390pF capacitors are not too plentiful, and there has been a tendency to use any odd capacitor which happens to be so labelled, tolerance notwithstanding.

While a large value can be justified, tracking can be badly compromised by values down around 350pF, which are apparently encountered in practice. After peaking the set in the normal way at about 600 to 1,300 Kc, it may thus be found that stations around 900Kc can be brought up markedly in level by further readjusting the aerial trimmer.

Losses of this order cannot be tolerated in a small receiver, and we feel that the conventional 425pF 5pc padder is a safer value to specify.

IF TRANSFORMER

The ultimate performance of the receiver depends a great deal also on the home-wound toroidal IF transformer. Electrically, it is a very simple unit, being made up of 41 turns of about 26 B&S gauge enamelled wire, tapped 14 turns from the "earthy" end. The whole winding is resonated by a 425pF 5pc capacitor, which can well be mounted on a scrap of bakelite clamped to the toroid.



This drawing shows the normal connections to a small transistor.

While this makes a very efficient IF coil, there is no guarantee that it will, in fact, be exactly resonant at 455 Kc. As might be expected, there is a tolerance both on the value of the capacitor and on the permeability of the ferrite core.

We suggest, therefore, that if you can possibly gain access to a modulated oscillator or signal generator, you wind a few extra turns on the collector side of the tapping. Then, after the set is completed and working, turns can be removed as necessary to bring the resonance as near as possible to 455 Kc.

CLOSE ENOUGH

We found that each turn removed in this region raised the resonance by about 8 Kc, so that it should be possible to steer the IF to within 4 Kc of the target figure, and this is quite close enough.

Alternatively, it would be quite possible to replace the 425pF fixed capacitor with a conventional variable broadcast padder and adjust it to resonance using the specified number of turns.

If the IF is not fairly close to 455 Kc, tracking may be compromised and a whistle may appear on any station which happens to lie close to twice whatever the frequency turns out to be.

Alignment in other respects follows normal superhet. procedure.

The accompanying diagram shows how the toroid is wound and shows also the reaction winding. We suggest three turns on this latter, although there is no objection to reducing or increasing the number by a turn or so if smoother reaction control is obtained thereby.

Despite all care with the drawing, it would appear that constructors are apt to be confused with the connections and/or the direction of winding. We suggest, therefore, that you follow the drawing, but if the detector will not oscillate with the full winding effectively in the collector circuit, you reverse the connections to the reaction winding and try again.

The remainder of the wiring is fairly straightforward, and should not require further comment.

The assembly board should be mounted as close to the metal baseplate as possible and it will not matter if the

BEST FOR STEREO

RONETTE FONOFLUID PICK-UP

"STEREO OV" MODEL
Frequency response. 30-12,000 c/s.
Output . . . . 700 mV
This is a high grade turnover unit for stereo or LP recordings. Standard ½in mounting centres.
Cartridge only £4/5/6
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A superlative stereo cartridge.
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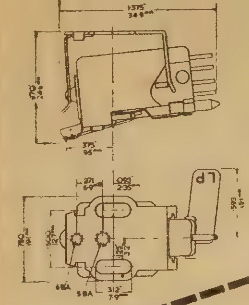
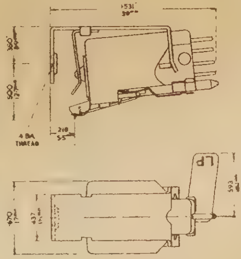
5-6 ANGEL PLACE,
SYDNEY.

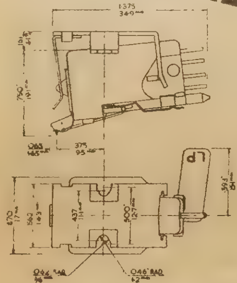


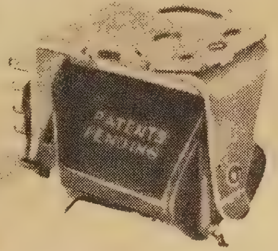
73·1a

73·1b



73·1c

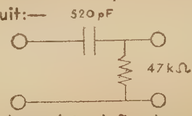




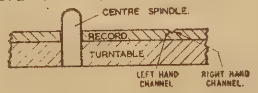
Crystal stereophonic cartridge

The "ACOStereo" 73-1 is a universal cartridge designed to play stereophonic and monophonic discs, including 78 r.p.m. coarse groove records. Three brackets are available. The "a" bracket fits the majority of arms, the "b" bracket fits Garrard RC. 110 and RC. 120 changers, and the "c" bracket is intended for American arms of the VM type.

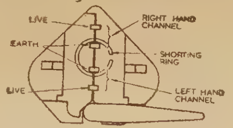
The output from the "ACOStereo" 73 is flat when fed into a 2 Megohm impedance. If record compensation is available in the amplifier, it is advised that the output is converted to constant velocity characteristics by feeding through this circuit:—



The left-hand channel is defined as the channel reproduced by the left-hand speaker when viewed by the audience, and is recorded on the left-hand groove wall when the record is viewed as:—


CENTRE SPINDLE.
RECORD
TURNTABLE
LEFT HAND CHANNEL
RIGHT HAND CHANNEL.

The "ACOStereo" cartridge connections as seen from the rear:—

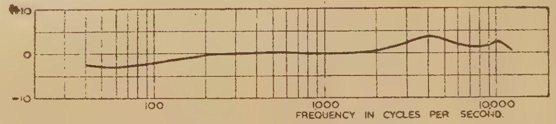

LIVE
EARTH
LIVE
RIGHT HAND CHANNEL
SHORTING RING
LEFT HAND CHANNEL

The shorting ring should be removed for use with amplifiers requiring separate leads.

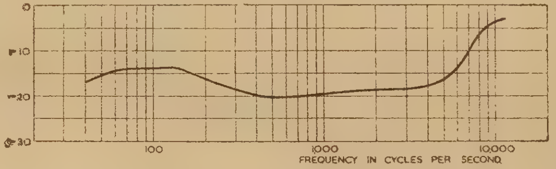
PERFORMANCE OUTPUT—160 m.v. at 1 cm/sec.
Average—300 m.v.

FREQUENCY RESPONSE—
40—12,000 c/s.
SEPARATION between channels at
1 K/cs better than 20dB
Radii of Stylus tips—0.0005" (13.5 microns).
0.0025" (62 microns).

Recommended load: 2 Megohm.
(Compliance equals 3.5 ucm/dyne).
(Stiffness equals 0.0286 x 10 dynes/MM).
Recommended downward pressure: 3-4 Grammes.
The Stereo recording characteristic is within ½dB of the RIAA/BS 1928-1955 characteristics, and cross talk is better than —20dB at 1 K/cs.



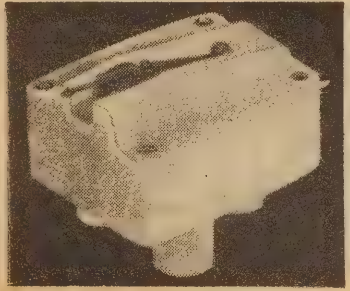
Frequency response on PS.131.



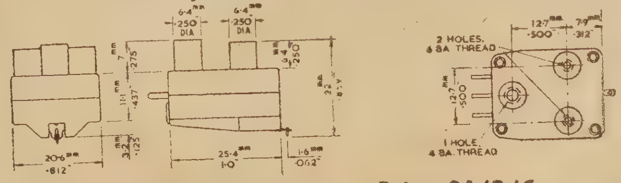
Separation between Channels on PS.131.

The response of both channels will be within 3dB.

All 73 series cartridges are available with two sapphire, sapphire and diamond, or two diamond styli.
Prices: 73 series—Cartridge incl. 2 sapphire styli, £5/15-—with sapphire and diamond styli £11/18/6—with 2 diamond styli £15/19/6.
Available ex stock.
"How Stereo Works" gladly posted on request.



71-3 For stereophonic discs only (non turnover type)


6·4mm
·250 DIA
6·4mm
·250 DIA
7mm
·275
11·1mm
·437
3·2mm
·125
20·6mm
·812
25·4mm
1·0
1·6mm
·062
2 HOLES.
4 BA THREAD
1 HOLE.
4 BA THREAD
12·7mm
·500
7·9mm
·312

With sapphire stylus — Price £4/9/6
With diamond stylus — Price £10/17/6

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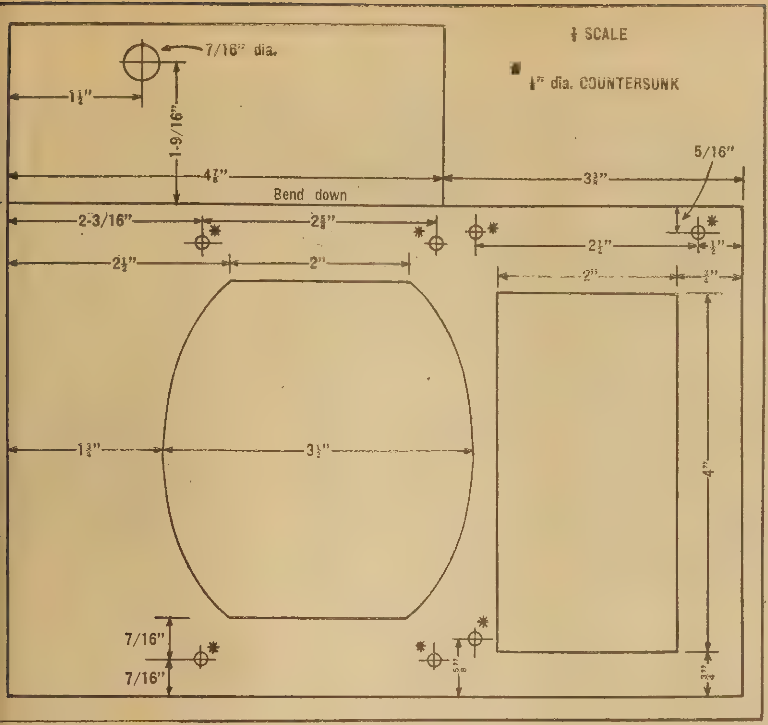
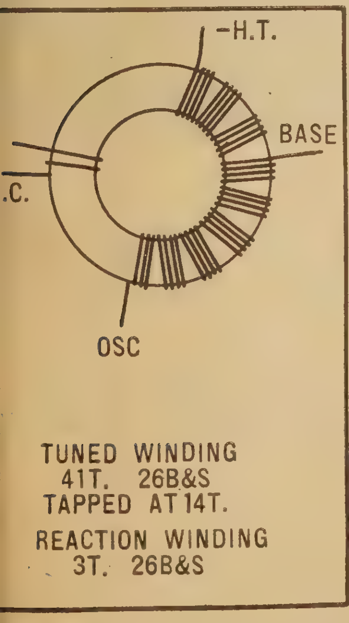


metal base plate can be bent up from aluminium or steel to the above dimensions. he holes in the cabinet for the controls can be slotted and countersunk internally to allow the receiver to slip neatly into position.

h wiring along the edge of the board bearing lightly against the speaker ne. This will help keep the dial ndle fairly close to the centre line of cabinet top.

n extension shaft is normally re- red on the tuning capacitor, this shaft the potentiometer being trimmed to gth only after the set has been fitted the finished cabinet.

he cabinet can be made up from p timber. We suggest that the top, bottom and sides be made from 3/8in material, the front being 3/16in or ¼in plywood. The removable back can well fit inside the framework thus formed, being held in place by a couple of pins engaging the top of the cabinet and by a couple of screws passing up through the bottom and into small blöcks attached to the removable back.



Here are the winding details for the oroidal IF transformer. Ideally, the unit hould be made to resonate close to 55Kc after the set is in operation, as mentioned in the text.

The finished cabinet should have the internal clearance dimensions shown in the parts list but, in any case, should be checked against the chassis dimensions with the battery in position.

Our own preference for a portable cabinet is a covering with a light quality leatherette or plasticised cloth.

The alignment procedure is as follows: Having first determined that the receiver is operating, advance the reaction control to the point of oscillation, then back it off a little to avoid obvious instability effects.

Now clip the output lead of the oscillator on to the case of the 2N252 transistor or through a capacitor to the base and identify the frequency to which the IF is resonant. Bring it close to 455 Kc by means indicated earlier in the article.

Attach the tuning dial to the capacitor and improvise a pointer so that it corresponds with the 550 Kc dial limit when the gang is fully closed. Tune to a station around 600 Kc and bring it to its calibrated dial position by adjusting the slug in the oscillator coil.

Leaving the tuning set, slide the aerial coil along the rod till the signal peaks in strength.

Now tune a station around 1300 Kc and bring it to calibrated position by adjusting the oscillator trimmer. Having done so, peak the aerial trimmer for maximum output.

Repeat the whole procedure more carefully and advance the reaction control to just below the point of oscillation.

NEW SUB KITS

FOR R. & H. TYPE

DESIGN TEST EQUIPMENT

Sweep and Marker Generator. Case, chassis completely punched dichromate plated ready for assembly and black enamellised calibrated and punched front panel. **£5/12/-,** plus 12½% tax, plus freight.

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Engraved front panel calibrated for any of the above types 50/-, plus 12½%, plus post 1/4.
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MC5A, 9 x 6.7/8 x 5½, 21/-, plus 12½% tax, plus postage.
MC82A, 13 x 8 x 6.7/8, 38/6, plus 12½% tax, plus postage.
SF7A, Sloping Front, 7½ x 7½ x 7¼, 21/-, plus 12½%, plus tax, plus postage.

Standard Instrument Cases. Finish Grey.

Cat. No.	Long	High	Deep	Price plus 12% S.T.
MC6	6	6	6	13 0
MC7	10	8	7	1 1 0
MC67	12	7	6	1 2 6
MC81	10	10	8	1 7 6
MC811	12	11	8	1 10 0
MC79	15	9	7	1 15 0
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SF7	7¼	6½	6	1 1 0
SE79	9¼	6½	7¼	1 5 0
SF71	11	6½	7¼	1 10 0
SF8	13	8	8½	1 11 6
SF10	18	10	10	2 6 0
SF79A	9¼	7¼	7¼	1 5 0
SF71A	11	7¼	7¼	1 10 0
SF8A	13	8¾	8¾	1 11 6
SF10A	18	10	10	2 6 0

Chassis unpunched can be supplied for any of above.

**Mackinnon and Nicholls Ltd.,
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Prices slightly higher Interstate.

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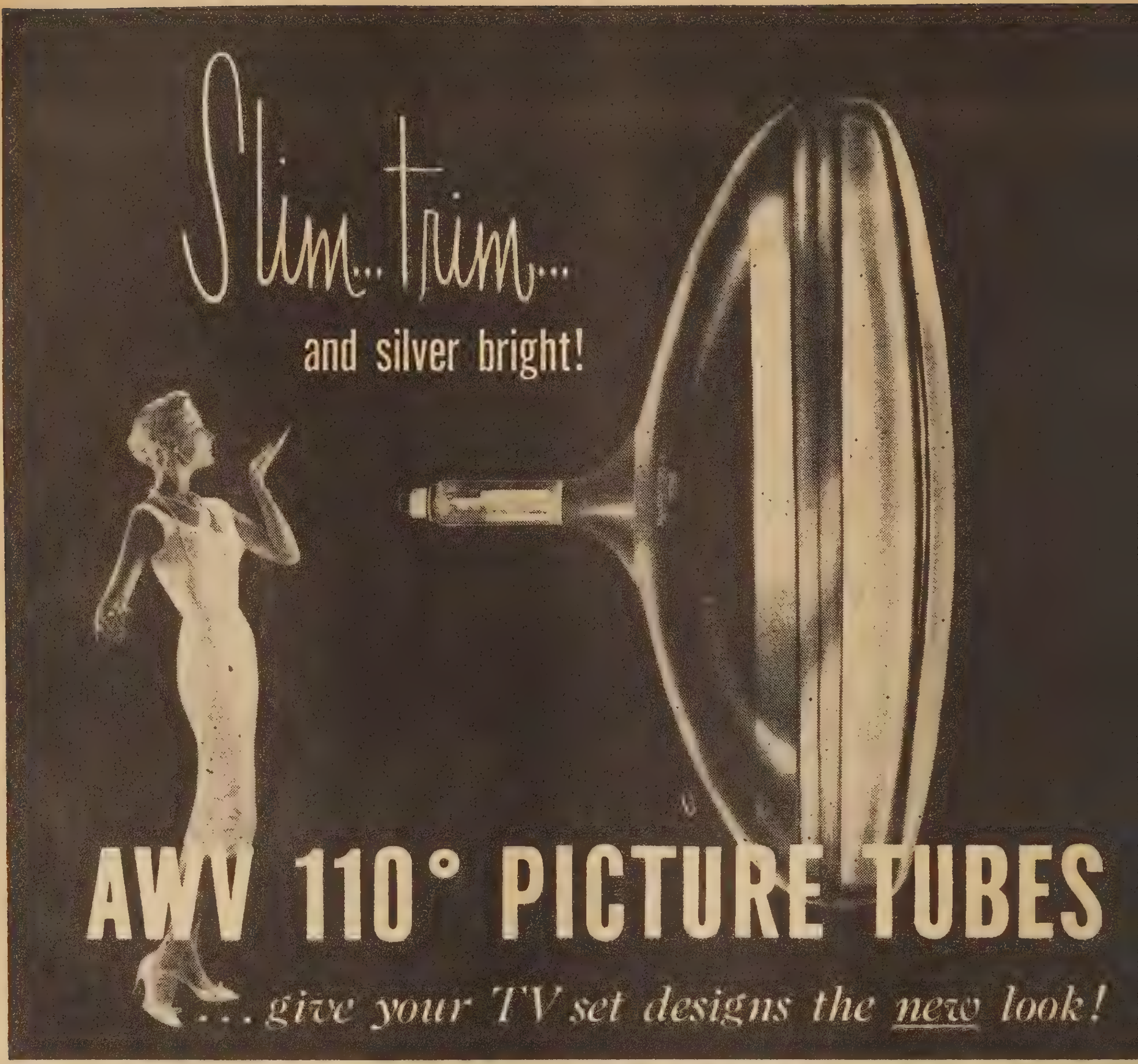
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AWV 110° PICTURE TUBES
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Throughout the fashion centres of the world, heads are turned towards the new "slim . . . trim" loo Manufacturers of TV sets who realize the power of female fashion trends, are designing lighter-weigh slimmer TV cabinets. To enable set manufacturers to maintain the highest standards of quality, AW have introduced 110° picture tubes into the Radiotron range.

AWV's "straight" electron-gun is designed to minimize deflection distortion — and eliminate tl need for an ion-trap magnet. Inches shorter in length than 90° deflection types having the same faceplat AWV 110° deflection picture tubes with super-aluminizing produce bright high-contrast pictures.

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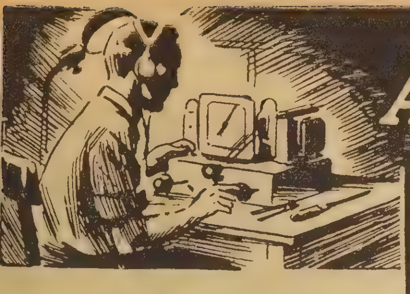
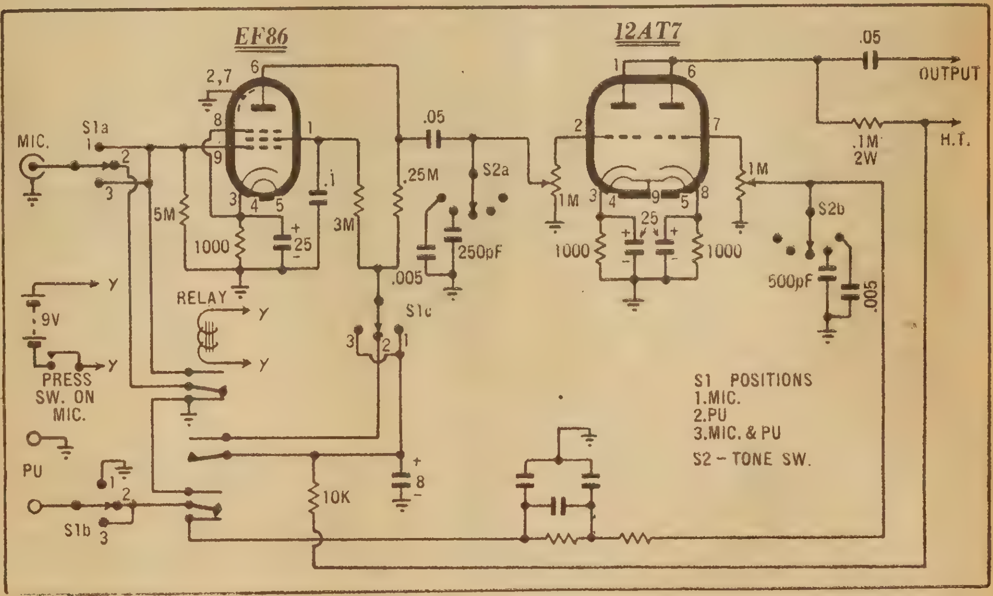


A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

NOVEL SWITCHING IN PUBLIC ADDRESS PRE-AMP.

Here is a circuit for a public address pre-amplifier mixing unit with a relay operated microphone/pickup change over system to permit this function to be carried out at the microphone position. Submitted by Mr G. B. Wolfe, P.O. Box 56, Bombala, N.S.W., it may prove of interest to other readers.



Main point of interest in the circuit is the use of a relay to switch from microphone to pickup operation. The Switch S1 provides an over-riding control to permit both channels to be mixed.

BASICALLY, the circuit employs a 12AT7 twin triode as a mixer for the microphone and pickup signals, using separate inputs, but a common plate load. Ahead of one input network is an EF86 as a microphone pre-amplifier.

As well as the separate gain controls, there is a selector switch (S1) which allows either channel to be selected separately or the two together. In parallel with this is a relay, operated from a press switch on the microphone, which allows either microphone or pickup to be selected separately. The mixing position must be selected manually by means of S1.

To minimise chances of cross-talk between channels the relay is arranged to short out the unwanted channel, as well as removing the HT from the pre-amplifier when the mic. circuit is not required.

As Mr Wolfe points out, the gain controls for the respective channels maybe pre-set so that a change-over from one to the other does not result in gross errors in level.

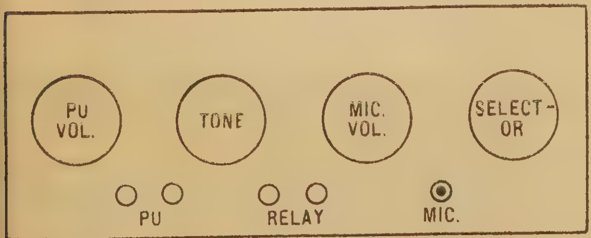
The circuit may be conveniently housed in a conventional Playmaster control box, as was the original, and a suggested panel layout is given in the accompanying drawing. A six pin plug and suitable cable is provided to permit connection to the main amplifier. The relay is a disposals type and is not particularly critical.

Two points about the circuit appear to warrant some comment. First, the separate cathode resistors and by-passes used for the 12AT7 could, presumably, be replaced with a single combination, resulting in a worthwhile saving in space and cost.

Secondly, there appears to be a compensating network of some kind in the pickup input chanel, but the details as to the component values or the exact purpose have not been given. Doubtless, Mr Wolfe would be able to supply the information to anyone interested.

In the circuit as shown the relay is energised from a separate 9-volt battery, and many readers may prefer nothing more elaborate than this. However, many disposals relays may be operated from the 6.3 volt filament supply, after the latter has been rectified through one of the popular disposals (telephone type) rectifiers which have been available in the past for as little as 2/, and normally rated at about 100mA.

Such an arrangement would make the entire system mains operated, self contained, and free from any chance of erratic behaviour as might occur with a failing battery.



☆

Housed in a conventional Playmaster control box, the controls may be arranged as shown. Terminals will suit the pickup, but the microphone will need a shielded socket

MAKE YOURSELF A TV SET . . .

TO THE "R., TV & H." CIRCUIT

It's easy to build your own TV Receiver, either 17" or 21", if you build it to the "Radio Television and Hobbies" circuit, and use the Electronic Parts high quality TV kit. The average handyman spending an hour or so at night can make his own TV set in less than a week. The set gives first rate performance, equal to the best commercials. You can save yourself upwards of £100 by building your own TV receiver.

NOW ALMOST ANYONE CAN MAKE HIS OWN TELEVISION SET !

- **Simplified Version for the Beginner**
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We offer you two methods of building the same "R., TV & H." circuit which appeared in May, 1958. All parts are identical, but the difference lies in that the Simplified version is a pre-fabricated form of the Standard version. In the pre-fabricated version all of the sectional wiring is carried out, it only remains for you to assemble the sections, which are pretested, and make the necessary connections

In the Standard Version, which is ideally suited for the technician, and hobbyist with some radio set building experience, you are supplied with all of the components to build up the "Radio Television and Hobbies" circuit.

ALL PARTS AVAILABLE

Yes, for those who may have commenced building their T.V. sets with components already on hand, we can supply any parts separately. Full stocks of spares are always on hand, such as Q + I.F.'s, potentiometers, valves, Philips and Q + tuners, deflection components, condensers, resistors, etc., etc.

TV CHASSIS

Ready drilled cad-plated and passivated, to avoid fingermarks. Complete with ventilated E.H.T. Box, etc. As supplied in our "R.TV. and H" kits.

Special Price £2/15/- (postage 5/- extra)
I.F. strip chassis 6/ (postage 1/ extra)

MARK III I.F. STRIP

Ready wired and tested, including Q + I.F.'s, and all valves as specified by "R.T.V., and H." May, 1958.

£19/16/- (postage 5/- extra)

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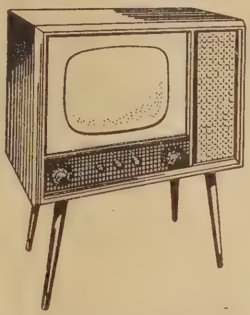
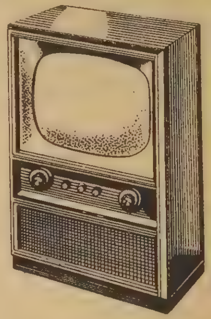
For your choice two extremely high quality cabinets which give your set that finish which is a combination of glamour, quality and dignity. Each is available in polished Maple or Walnut.





(Above) CONSOLETTE £26/0/0
(Right) CONSOLE £24/17/6
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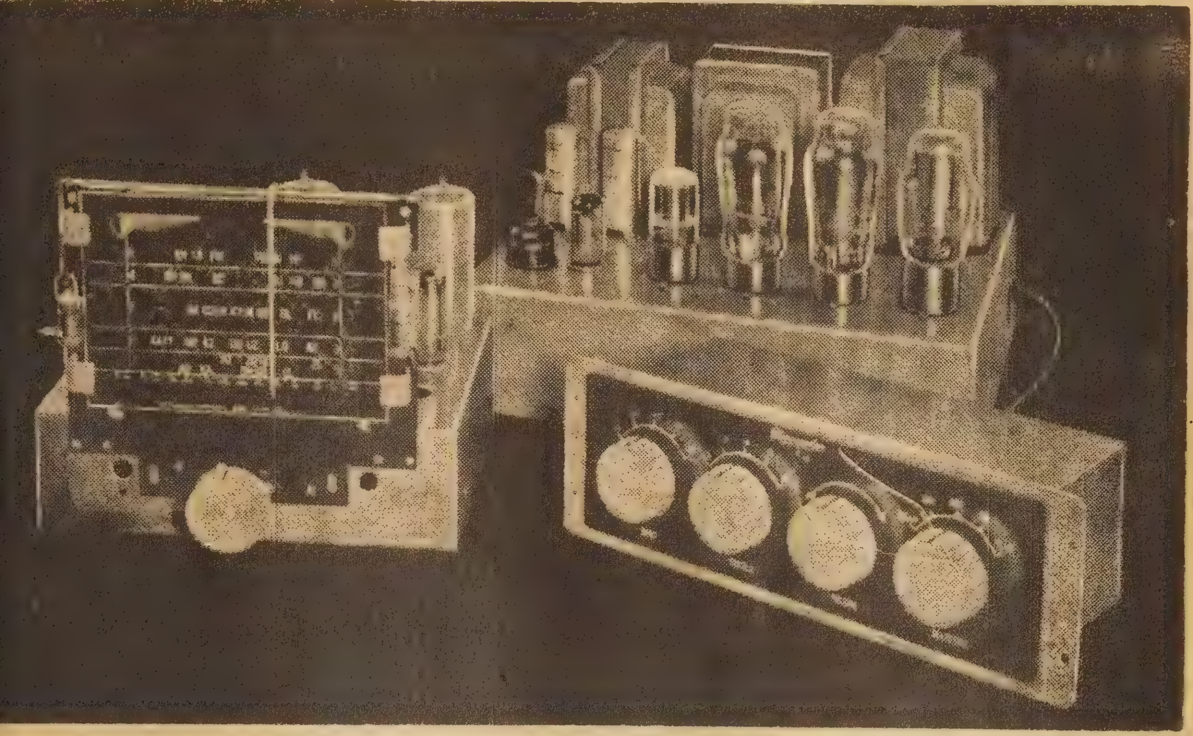


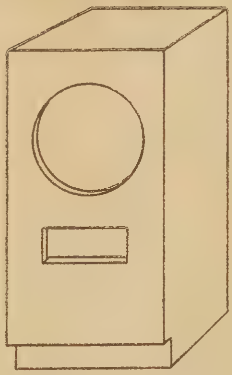
PLAYMASTER HI-FI OUTFIT

Designed by "Radio, Television and Hobbies," this high-grade equipment offers combination of units to suit every requirement. Quality of reproduction on performance and figures is amazing. Furthermore, the cost is much lower than that of similar powered imported units. If you prefer to build your own hi-fi gear, we can supply the kit of parts containing precisely the same high-grade components as are used in the completely built unit.

The range includes high quality amplifiers from 17 watts to 5 watts, control units, and a complete range of tuners (including the latest F.M. tuner). You are invited to write, phone or call for Illustrated descriptive catalogue.

STEREO AMPLIFIERS

Interest is growing rapidly in stereophonic sound and we are happy to announce that kits or completely built units are now available for the STEREOPHONIC AMPLIFIER designed by John Moyle ("R., TV and H.," July, 1958). PLAYMASTER 10-watt U.L. STEREO AMPLIFIER ("R., TV and H.," Jan., 1959). STEREO CRYSTAL CONTROL UNIT ("R., TV and H.," October, 1958) STEREO PICK-UPS and CARTRIDGES ALSO AVAILABLE. Send coupon for price and full details of all HI-FI items.



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Made to our specifications, these famous "Easybuilt," speaker enclosure packs are suitable for most types of hi-fi speakers. Their compactness makes them ideal for stereo. They are made of $\frac{7}{8}$" solid timber, and give a beautiful appearance either painted or stained. Full building instructions go with each kit. The price is amazingly low. Send for descriptive booklet.

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LOUDSPEAKERS
for

STEREO

Model 8MX, the latest addition to the Rola family of extended range loudspeakers, has been developed specially for use in stereophonic systems. This 8 inch loudspeaker requires only a 1.9 cubic foot capacity vented enclosure for peak performance, a feature which makes it ideal for two-speaker stereo units in the average-sized living room in which the large enclosures needed for the 12MX, 12-OX and 12UX take up too much space. Hear the Rola 8MX — its tonal quality will astound you!

ROLA MODEL 8MX STEREO LOUDSPEAKER SPECIFICATIONS:

Power handling capacity	7 watts peak
Diaphragm	
Fundamental resonance	65 c.p.s.
Frequency response	60 c.p.s — 10 k.c.
Voice coil impedance	15 ohms at 400 c.p.s.
Air gap flux density	9,350 gausses
Total gap flux	36,800 lines
Principal dimensions:	
Overall diameter of diaphragm housing	8¹⁄₁₆"
Diameter of baffle opening	7"
Diameter of voice coil	1"
Depth of pad ring to rear	3½"
Finish:	
Baked enamel diaphragm housing, magnet shell black lacquered	
Transformer	Type C
Weight	1 lb 7¼ ozs. without transformer

ROLA COMPANY (AUST.) PTY. LTD.

NEW BOOKS

"BASIC ELECTRICITY" in five parts. Published in London by The Technical Press Ltd., dated January, 1959.

According to the preface to this book (or rather books) the U.S. Navy in 1954 commissioned Messrs Van Valkenburgh, Nooger and Neville Inc. to produce an illustrated training course which could be used as a standard text in the U.S. Navy training schools.

Later, when the Royal Electrical and Mechanical Engineers' Headquarters faced the task of finding a similar text for British Army training, it saw fit to adopt and adapt the American text for its own purposes.

"Basic Electricity," parts 1 to 5, is essentially the British R.E.M.E. course brought right up to date and offered as a civilian textbook. More than half the total space is given to bold line drawings and the student is taken from the basic electron theory through simple circuits, batteries, DC and AC theory to components found in electrical circuits, measuring equipment and rotating machines.

The treatment is strictly non-mathematical, being directed rather towards a pictorial easy-to-read presentation. It is designed, not to train engineers, but to produce technicians able intelligently to operate and service electrical equipment in the field.

Each of the five books contains about 120 pages and, although presumably offered separately in England, should be bought as a set to derive greatest benefit therefrom.

An examination of the text indicates that a great deal of thought has gone into its presentation and the books can be recommended to anyone who wants to embark upon a non-laborious course of study.

According to the brochure, the publishers are about to release a companion course in electronics, which should also be of interest to our readers.

Our copy came direct from the publishers and information as to local price and availability would have to be sought from local technical booksellers.

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Let's Buy An Argument

I notice from a few letters in the daily Press that people are beginning to think hard about something which is overdue for an airing. I refer to the question of insurance, as applied to television receivers.

by **Neville Williams**

EVEN before these letters appeared in the Press, I had been making a few personal observations, not because I have any direct interest in the matter, but because it has more or less been thrust upon me on various occasions.

For example, I walked in on a distant relative a few weeks back and found him muttering over a letter which had just come to hand from the insurance firm with which his television set was covered.

HIGHER PREMIUM

I can't remember the exact wording of the letter, but it advised him that the cost of insuring television receivers had turned out to be much higher than the company had anticipated and that it regretfully had to advise an increase in the premium. Would he please remit an amount of so much (about £10, I think) to cover the cost of insurance for the following 12 months.

My friend was quite irate. How was it, he asked, that a firm with so much information about insurance rates overseas should suddenly find that it had underestimated costs in Australia by so much? And was it fair to demand such a high premium when he had made no demands on them personally?

In any case, the policy didn't really provide free service. He'd gathered from what friends said that, if anything did go wrong, he'd still almost certainly be up for a portion of the cost.

I had to point out, in all fairness, that the television scene in Australia, both technically and economically, differed from the U.K. and the U.S., and that some latitude had to be expected between provisional and ultimate insurance rates.

Further, that he could consider himself fortunate in having a trouble-free receiver. The experience of many others was quite different. If he—or they—had to pay part of the service charge, it was only in accordance with the policy to which they had knowingly subscribed.

The question, from his point of view was simply one of balancing his reluctance to pay a certain order of premium against the financial embarrssment which could result from being solely responsible for one or more major repairs should they become necessary.

If he could cover such a major repai bill without actual financial embarrassment, he may be better advised to carry the risk and save on the premiums meanwhile.

These observations seemed to change my friend's mood somewhat, and he made to conclude the discussion with a remark along the lines:

NEW PICTURE TUBE?

"Ah, well, I suppose it'll be all right in a couple of years' time, when they have to present me with a new picture tube."

My retort to this seemed to surprise him: "Do they now? Is that what your policy says?"

My friend had never read his policy, or at least never paused to consider what it actually said. He'd vaguely assumed that payment of the premiums would safeguard him against having to meet the cost of replacement components for ever and aye and, in particular, the cost of a new picture tube.

Whatever else his dealer had said about the policy, he'd certainly never disabused him on this vital point.

I have gathered the very definite impression, by talking to people, that this man is by no means a lone figure. Having been concerned by the prospect of costly repairs and, in particular, by the chance of picture-tube failure, most TV set buyers have subscribed willingly enough to an insurance scheme at the time of purchase.

THE POLICY

However, they have never read their policy through, observed its limitations and provisions or analysed its economy in relation to their own financial position.

Nor have their suppliers gone to any trouble to explain the exact terms of the policy, even assuming that they understand it themselves. As one dealer said to me: "You just wouldn't do that . . . and expect to sell insurance!"

In consequence, the policy is put away in a drawer somewhere and assumed to be a kind of automatic cure-all for any trouble that may ultimately crop up. Actually, this is likely to be a very long way from the truth.

As it turned out, my friend's policy was one of those which stated that the insuring company would meet the cost of components which had become inoperative or which had failed completely to function. Whatever else these words might signify, they are certainly not synonymous with "unsatisfactory."

If they are interpreted strictly, as they apparently are in some cases, they very seriously reduce the value of the service cover. Let me quote two specific examples, of which I have a personal knowledge:—

A serviceman employed by a suburban radio dealer was called to a receiver which suffered from chronic instability of the line oscillator. It would seem to hold well enough on some occasions, but be quite hopeless on others. It had been the subject of a good deal of previous dissatisfaction and argument.

It turned out, ultimately, that the line oscillator valve was faulty, probably gassy, so that there was a major variation in its behaviour between the "switch on" condition and after reaching normal operating temperature.

TWO WAYS

The serviceman found that he had the option of adjusting the receiver in one of two ways:

(1) So that it would operate normally for the first 10 minutes, then lose synch.

(2) It would not synch. for the first 10 minutes, but would thereafter be normal.

Naturally, neither solution was satisfactory, and a new valve had to be fitted. But, here was the rub: Though the set was insured, the customer had to pay full price for the new valve because the original one was not completely inoperative.

Having to pay for an odd valve is possibly of no great moment, but the principle involved is. That "valve" could ust as easily have been the picture tube tself.

In my own receiver, I have a picture tube which, as far as I can determine, has an intermittent connection between the cathode surface and the pigtail leading back to the base pin. Every two or three weeks the circuit opens and I have to tap the neck of the tube gingerly with the handle of a table knife to restore the picture to normal.

When the fault is in evidence, there s only limited illumination on the screen and it is streaked with retrace ines. By turning the contrast to maximum, the action can be followed — but only just.

I had the opportunity of "trying this one out" on a friend who investigates and adjudicates on insurance claims for a particular company.

I pointed out that it was a clear manufacturing fault, which would doubtless be admitted as such by the maker or the local representative; that the tube was beyond the normal guarantee period; that the picture on the screen, with the fault in evidence, could only be seen in near-darkness, and that, in any case, it was completely unacceptable to me, as the owner.

Assuming that the set was covered by the particular policy, would the tube be replaced with a new one?

"Tell me," he said, "has it completely failed to operate?"

"No . . . but . . ."

"Well, it doesn't qualify for replacement."

The implications of this are pretty serious. Of what real value is such a cover on the picture tube, particularly when the following points are considered?

Statistics show that most major mechanical faults in a picture tube show up within the first few months of it going into service. Since the tube is normally covered during this initial period by a full maker's warranty, insurance cover would seemingly confer little advantage in this respect.

After this initial period, the likelihood of complete failure is remote.

INSURANCE ON TELEVISION RECEIVERS

- **Have you read your own policy?**
- **Does it provide the cover you thought it did?**
- **Did your dealer carefully explain its provisions?**
- **Would it be more economical to carry the risk yourself?**
- **Are you, alternatively, well satisfied with TV insurance?**

We'd like to hear your views on these matters, which, shortly, will be of such vital interest to prospective set buyers in Brisbane, Adelaide and Perth.

Occasionally, a weld may become unstuck and cause the sort of trouble I have just described.

A grid may become detached and cause loss of brightness or focus.

Grid current may become evident and cause loss of brightness control, the picture tending to flare, no matter how the control is manipulated.

Cathode emission may diminish prematurely, causing bright parts of the picture to turn "negative" when the brightness control is advanced to compensate.

The screen may suffer ion burn or other mechanical damage, so that the pictures will thereafter be "decorated" by one or more dark spots.

But, in none of these cases would the tubes become officially "inoperative" in the view of this particular person.

NO NEW TUBE

The set owner would wait in vain for a man to arrive at the door with a free, brand new picture tube on a s'il vous plait!

(I hope your French is equal to the multi-lingual pun.)

No, he'd sit and stare at the still "operative" screen until he could stare no longer—then go out in desperation and buy a new tube, with his own hard-earned cash.

At first glance, the "answer" to this situation seems to be very obvious and I've had it put up to me quite seriously on more than one occasion. If a fault develops, which is troublesome but not sufficient to warrant replacement, the set owner or the dealer merely flashes the 240-volt mains across the heater, burning it out and rendering the tube quite definitely "inoperative." He then lodges a claim.

But alas, quite apart from the honesty of otherwise of such action, it won't stand up to examination. A dealer who sets out to "help" his clients by doctoring tubes or components may find himself betrayed by statistics.

I gather that insurance companies are compiling quite accurate statistical records of the incidence of failure of various valves and components in typical receivers and falsified claims stick out against this background like the traditional sore finger.

Even on an individual basis such "initiative" may not pay off. A tube heater which has been ruptured by excess voltage has a quite different appearance from one which has gradually weakened and parted and an expert is not likely to be deceived thereby.

If the insurance company refuses to meet a claim on such grounds, a rather interesting position can result. Mr Dealer or Mr Set-owner threatens to take action for failure to honour the contract. The insurance company threatens a counter action for attempted fraud, with evidence to support same!

Fortunately, for many set owners, the strict letter of the contract has not always been followed to date. Component manufacturers have effected free replacements and modifications to protect their good name. Established dealers, with an eye to the future, have often gone the proverbial "second mile" in regard to service.

In addition, some insurance companies, who carry a "complete failure" clause in their contract, actually operate on the much more liberal principle of replacing a part when it is merely unsatisfactory.

That's fine but the disturbing fact remains that a clause is retained which could presumably begin to operate overnight to the disadvantage of dealers and set owners by a decision of the executive.

I know retailers who have worried over this possibility enough to take their insurance business elsewhere. Others, who say they have had a "fair go" to date, are apprehensive of the future, particularly as they see the current tendency to tighten up on claims.

WILL AXE FALL?

They are wondering, as one put it to me, "when the axe is going to fall."

Policies which operate on a "replacement if faulty" basis would seemingly overcome the aforementioned objections; whether they do it economically is another matter.

But once again I'm not too sure that the position is quite as clear as the salesman or prospectus would have one believe.

I inquired about one such policy, as a prospective set owner might do, and was assured most solemnly that a new receiver could be covered for at least four

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ars; that the cover would look after free replacement of all components ich become faulty or unserviceable that period.

"But let's assume," I inquired, "that ar the end of the fourth year, my cture tube has lost emission in the ocess of ordinary use, to a degree iere the picture is plainly unsatisfac- ry and unacceptable. Would I get a w one free?"

"Yes," was the answer.

I might have been convinced, had it not been for the fact that there is a specific provision in the policy to the effect that the picture tube will NOT be replaced if, as a result of fair wear and tear over a period of use, the picture is not as good as that in a new set.

Is the salesman to be believed, or the rms of the policy? And what does a licy mean, anyway, when purely com- rative phrases are substituted for pre- se obligations? What is fair wear and ar and who defines it? How bad is not good as in a new set? At what rate es emission failure cease to be natural ear and tear and become a "fault," arranting replacement?

/HAT IS ANSWER?

It seems to me that the answers to ese and many other vexed questions st, for the moment, on precedent — hat the insurance companies find it actical to do. But remember that ey are based on a unique situation. ost television receivers are virtually iew;" original replacement parts are adily available; very few picture tubes ive run out of emission.

But insurance companies are allegedly sing money already on television main- nance and who knows how soon and what degree they will be forced to andon precedent and fall right back on e "inoperative," the "wear and tear," id the "depreciation" provisions in their licies?

In the meantime, selling insurance ong with the set has become an integral irt of the business. The retailer has be in it so he can offer "free" ser- ce; the customer has to buy it because regards free service as his right; the iance company stands to gain because 's all extra finance and a comprehensive licy is excellent protection for its own terests.

But I wonder whether everyone con- rned will be equally happy some time nce, when possible disillusionment sets ? When Mr Client, having paid £50 more of insurance over four or five ars, has to be told that he must pay 40 for a new picture tube, because e old one has legitimately worn out?

L-WILL

When, immediately thereafter, a new ccount has to be presented . . . insur- nce premium for the forthcoming year . . . is it being less than realistic to iggest, at that stage, that a great many eople are going to tell dealers and ser- cemen and insurance companies to go mp in the lake and take their adjec- val business with them?

If the premiums were half the present gures, there would be less cause for ssatisfaction. They would bear a more alistic relationship to the capital value the item insured.

Unfortunately, indications seem to be that the trend can only be up, not down.

What is equally unfortunate, it seems that dealers and repairmen are themselves largely to blame for this state of affairs. Overcharging and malpractice have become so rife that insurance companies, who were once prepared to take a service document as read, have been forced to institute checking methods, carry out private investigation and refer certain cases to the police for action.

I have a standing invitation to view the "exhibits" which one company is collecting to show the nature and extent of such malpractice.

Only this week, a technical friend told me of a receiver belonging to a close relative. The picture failed and a call to the serviceman elucidated the information that the line output transformer had definitely failed. Repair would cost a certain considerable sum — a firm quote — which part would be borne by the insuring company.

Before the serviceman was commissioned to go ahead, my technical friend

MAGNETISM, COMETS, SPACE, &c.

Dear Sir,

Having read Calvin Walters' article on The Source of Earth's Magnetism and followed it up with Space Travel, Comets and like items, I find the letter by S.V.H. very interesting indeed.

I, too, ask "What's wrong with having a little mental meander in nearby meadows?"

Among the things which I have considered in my own meanderings is what goes on in space?

Not being a professor of astrophysics I feel rather diffident about putting my neck out and proclaiming my ideas; but that letter by S.V.H. has tempted me to do so. The ideas put forward by S.V.H. have some resemblance to my own, but I regard the sun as the source of the magnetic field of the earth, and also the source of many other natural phenomena.

I regard the universe as an enormous radio valve, cathode-ray or X-ray tube, having a high vacuum and numerous electrodes.

The hot sun I visualise as a Cathode, pelting electrons into the vacuum of space, as in any hot cathode radio valve. Some of the sun's electrons encounter cooler electrodes, such as the planets and as in the radio valve a negative charge is built up on those electrodes.

If the electrode of a radio valve is an open circuit we get a space charge surrounding that electrode.

In the case of a planet we have a space charge in the form of a Heaviside layer, the layer being held away from contact with the earth by repulsion of the negative charge on the earth.

The West to East rotation of the earth beneath this swarm of electrons amounts to the same thing as a huge current flowing East and West around the earth, hence North and South polarity at right angles to the electron flow. Meteorites drawn into the sun by gravity, become hot and vapourise explosively. The pattern of the electronic discharge from the sun cathode is varied. Variation of the cathode stream varies electrode potentials. Magnetic field varies with the circulating current, hence magnetic storms caused by sunspots.

In my mental meanderings I make my ideas fit in as an explanation of many things from tides and weather to comets' tails.

Here's wishing Neville Williams, Calvin Walters and S.V.H. pleasant meanderings.—(A. H., Q'ld.).

★ ★ ★

Dear Sir,

Previous correspondent shows that there has been no criticism of Calvin Walters: on the contrary a continuance of his interesting style is desired.

To shed some light on what this is all about, it might be a good plan to review the definitions of some relevant terms and ponder the consequences of the indiscriminate use of those terms.

The Earth's magnetic poles were given the terms North, and South, derived from geographical orientations.

Artificial magnetic poles had the complex terms North-seeking, and South-seeking, which for brevity were indiscriminately reduced to the simplified and loose forms North, and South, by dropping their second terms "seeking,"

But North is the converse of North-seeking, and poles were thus effectively transposed.

It is now the common rule for all artificial magnetic poles to be known by their simplified converse terms North and South, hence it is necessary to transpose the terrestrial poles to retain the original relative sense.

And since "unlike poles attract" then an artificial North is attracted by a terrestrial South located in the northern regions of the Earth.

The eddy current diagram on page 17 of December issue shows a "North pole" at the top exactly as we find it (as stated on page 19), and in the northern regions of the Earth.

This indiscriminate use of terms has thus led to the sorry spectacle of all LIKE poles tending toward the same regions of the Earth — which of course is nonsense.

The transposition made effective by the common rule dictates that a South pole is required for northern regions.

It does therefore seem that something is fundamentally wrong with the accepted hypothesis of the source of Earth's magnetism.

The foregoing underlines the need for Standards to be brought up-to-date.

Yours faithfully,

S.V.H.

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OC76
TS1
TS2
2N185
2N247
2N252
2N301
2N308
2N309
2N351
2N376
2N384

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happened on the scene. It took him a few minutes to establish that the sole fault was failure of one small resistor. supplying the screen of the line output tube. A few minutes' work, a shilling resistor, and the set was back to normal.

It may be argued, of course, that the serviceman was genuinely mistaken, but such incidents conform to a definite pattern and have a very definite unsavoury quality.

One of the greatest headaches for insurance companies are the so-called "valve jockeys." These are "repairmen" whose standard approach is to pull and replace valves until the fault seemingly disappears. They ignore the fact that a different valve may merely be the substitute for a circuit adjustment; that it may work for a while, simply because it is a new and different valve; that a valve substitution may disturb a circuit intermittent for a while and restore a set temporarily to operation.

GOOD VALVES DISCARDED

Large numbers of perfectly good valves are thus discarded, leaving set-owners or insurance companies to pay for the new ones—and leaving the original circuit fault uncorrected.

Lest this seem like an exaggeration, let me quote the case of a dealer friend, who was suspicious of the number of valve replacements being effected by his own staff. (I have known him personally over many years.)

To demonstrate the possible point, he had them set up a standard 21-inch Astor TV chassis near the service bench, where it could be under constant surveillance. He then proceeded to remove the original valves one by one and plugged in sixteen substitutes which he picked out of the "reject" box.

For the next two days and nights, the receiver operated without even a sign of a fault, despite switching operations, adjustments and bumpings—with no less than sixteen "dud" valves which somebody had paid to replace!

About the whole situation, there is the unhappy atmosphere of a serviceman's bonanza. Why try to economise and avoid wastage if you can charge it up to insurance? After all, if you say the right thing, you can leave the customer with the impression that you've helped him get some return for his outlay.

The fact that you've also helped to boost next year's premium escapes immediate notice.

Personally, I can't escape the conviction that the idea of insuring television sets against breakdown on a long term basis is destined to become hopelessly uneconomic and unworkable. During the initial and repayment period some limited insurance may be desirable and necessary but after that . . . no!

It is perfectly true that television receivers, on the whole, do require a lot more service attention than do radio receivers. But it is equally true that bloated charges and bloated publicity have exaggerated the likely and ultimate cost of such service.

And need it be any more of an embarrassment than paying bloated premiums or the dentist or the council rates?

Statistics reveal that one person in every four in Australia owns a motor car. If a gearbox fails, or a differential, or a set of engine bearings, the motorist has to bear the very considerable cost of repair. He doesn't expect to insure against mechanical failure, nor does he naively believe that some Father Christmas of a policy could replace his tyres when they wear out.

Why then all the panic about paying for TV service and the naive ideas about new picture tubes for old?

TIME PAYMENT TUBES

It seems to me that an excellent opening exists for someone to develop a business selling picture tubes on a time payment basis in the event of a replacement becoming necessary.

It should be possible to work out some restricted insurance scheme to protect the financing company during the repayment period. It should equally be possible to amend or supplement the maker's guarantee to a pro-rata basis, whereby the replacement obligation would vary from 100 per cent when new to nil at the end of a stipulated service life.

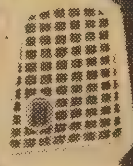
What is the conclusion of all this? Am I about to come up with some pet brainchild? Am I getting set for a campaign against television insurance? Or against dealers and servicemen?

No, no and again no!

I'm just wondering in print about something which seems to me to carry the seeds of a good deal of misunderstanding and ill-will. About how intelligently or otherwise TV set owners are paying their premiums. About what they're getting in return or vaguely expecting. About the real value of new policies currently being taken out on ageing receivers.

Discussion may serve to crystallise thinking; it may show that set owners are getting good value for their premiums; it may show the reverse.

It's over to you!



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10 VALVE HI-FI STEREOGRAM CHASSIS

Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response 50 to 10,000 cycles. **£48/15/-** F.O.R.

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8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 3-3" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles.

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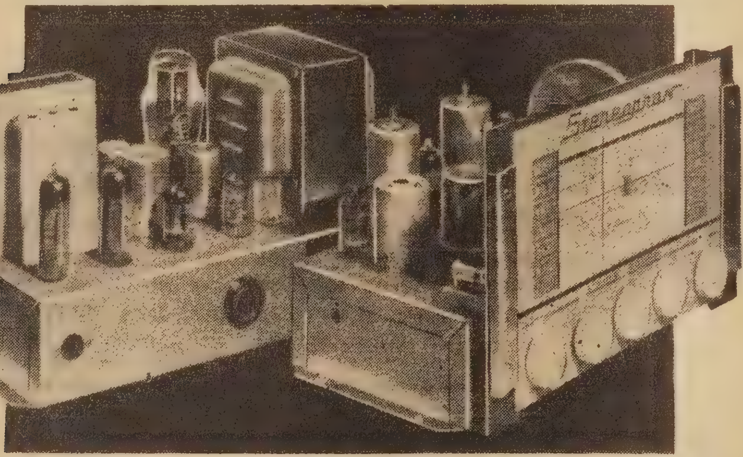

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SPECIFICATIONS ON OPPOSITE PAGE

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WITH BASS AND TREBLE BOOST

The ideal chassis for those difficult locations where reception is doubtful. Specifications as nine valve unit, but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short wave bands.

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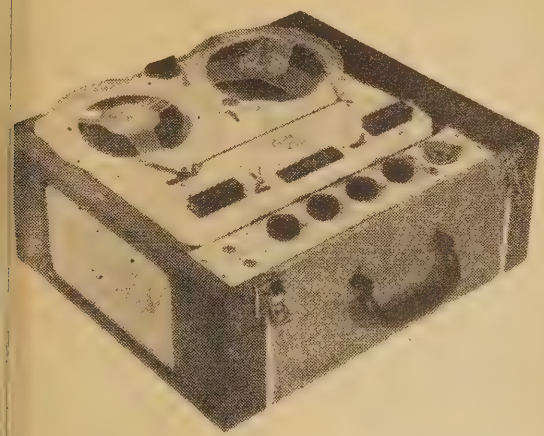
Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145

3uying a Tape Recorder?

'irst see and hear the new Hi-Fi Recorder by Classic incorporating the iew Collaro Mark IV Transcription deck. The only deck with ALL these features.



- **HIGH FIDELITY**
  Heads are double coil wound and will reproduce up to 12,000 c.p.s. at 7½ inches per second. Azimuth adjustments on both impedance "record" and "playback" heads. Output of heads is approximately 5 milli-volts at 1 Kc at 7½ inches per second.
- **INSTANTLY REVERSIBLE**
  Instantaneous changes can be made from one track to the other. Fast rewind in either direction
- **CONSTANT TAPE TENSION**
  A special Collaro device ensures a constant tension on the tape on the take-up spool as it leaves the capstan.
- **FULLY MECHANICAL**
  No solenoids are used in the construction of this Transcriptor. The braking is entirely mechanical.
- **FINISH**
  Cream Polystrene cover plate with maroon controls.
- **THREE SPEEDS**
  3¾, 7½ and 15 inches per second.
- **FOUR HEADS**
  Two "Record/Play-back" and two "Erase" heads are fitted on two different levels and head wear thus halves for any given length of track
- **TWIN TRACK OPERATION**
  One pair of heads for each track. Both top and bottom tracks can be recorded or played back without removing tape.
- **PAUSE CONTROL**
  This has the effect of stopping the transit of the tape past the "Record/Play-back" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURING & CALIBRATING DEVICE**
  The three digit counter makes the location of any recorded passage the simplest of operations.
- **TRANSCRIPTION TECHNIQUE**
  A large diameter flywheel with ground and lapped steelshaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 to 1.0 per cent
- **TWO MOTORS**
  Each dynamically balanced motor does only one job at a time. Motors never act against each other and are of low wattage input with consequent reduction in heat and wear.

**HE COMPLETE UNIT IS SUPPLIED IN
TTRACTIVE AND DURABLE TWO-TONE
OVERED CASE COMPLETE WITH ACOS
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l to C.C.R. standards giving perfect reproduction from
orded tapes. Record monitoring and outlet to power
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spex dress plate to match deck.

COMPLETE RECORDER WITH MIKE — 84 GNS. f.o.r.

DECK WITH AMPLIFIER, POWER SUPPLY and 6in x 9in SPEAKER, 71 GNS.

MPLIFIER AND POWER SUPPLY FOR COLLARO DECKS WITH VALVES (7) £34/10/- f.o.r.

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

IEW:

**ramodern circuit using nine high gain valves including "magic eye"'
ng indicator, Permatuned iron cored coils and intermediates giving ex-
ent interstate reception and a short wave range of 12,000 miles. All
'es used are the new Mullard nine pin Innoval series.**

IEW:

**e control and audio stages incorporating the Mullard 5/10 amplifier
uit with separate bass and treble controls giving plus or minus 15 db
st or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull
out with inverse feed-back gives you really high fidelity reproduction
n your radio or favourite recordings.**

IEW:

**l speaker combinations using the new Jensen M.S.P. 12PR woofer
matched tweeter and cross-over network giving a frequency
onse of 40 to 12,000 cycles. If required the Rola 12MX speakers can be
lied (with the 8 valve stereo chassis, two Rola 8MX speakers are
lied). A.W.A. output transformers used on all units.**

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo, F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.

All chassis are wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.

Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145

Amplification Communication Electronics

ACE RADIO

PHONE LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W

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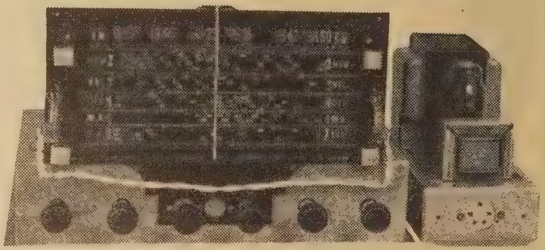
STEREOPHONIC RADIOGRAM

Sound faithfully reproduced to give utmost realism in your own home. You can hear every instrument with lifelike clarity and full directional effect of natural sound from 2 speaker systems with 2 audio channels synchronised volume and bass and treble boost controls. Designed for the new stereo discs but 100 per cent better sound from your present microgroove or standard recordings.

10 valves, 6BA6, 6AN7, 6BA6, 6AV6, EM80, EF86, EF86 EL84, EL84, 5V4. Dual Wave. Tuned R.F. stage. Input for stereo monaural. Mike, TV Tape Recorder. 2 Rola Twincone Speakers.

£47/15/0



STEREO RADIOGRAM KITSETS

5 VALVE

6AN7, 6N8, 6M8, 6BM8, 6V4
Bass, Boost, Treble Cut.
2 Jensen 12in Speakers
Complete Kitset, including Valves Speakers, Circuit
6 watts output

£29/-/-

Wired and Tested.

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8 VALVE

Dual Wave Stereogram, Octal Series Valves.
2 Jensen 12in Speakers
10 Watts Output
Bass and Treble Control.
Complete Kitset, including Valves, Speakers, Circuit

£29/17/6

Wired and Tested.

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14 VALVE STEREOGRAM CHASSIS

Twin Chassis, Twin Push Pull Hi-Fi Amplifier, 14 watts of wide-range reproduction.

4 Jensen speakers ensure 100 per cent better quality on radio or your present records and superlative quality on the new stero discs.

£57/17/6

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R. and H. Stereogram Kit including Control Box.

£52

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VACUUM TUBE VOLTMETER

Kitset including cabinet

£24

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6 V Input 40 watts.
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Complete with all valves, picture tube and construction manual.

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Steans, Philips, AWA Mullard, Astor

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90 degree

14"	**£22/-/-**
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Fully guaranteed

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Complete with Valves Aligned & Tested

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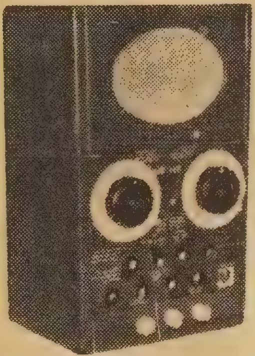

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12v., 420 watt. Prefocus Globes, 7/6

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Suitable for TV Pic. Tubes.

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1J6	12/6	47	12/6
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3A4	15/	828	£2/10/
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3D6	10/	957	10/6
6AG5	7/6	1625	£1
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6J6	15/	2050	£1
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24 to 32V input 300V 250 M.A. Out Used 1-5-0.

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350 x 350v extended to 1000V, 6.3, 6.3-2.5 4V filaments £4/5/

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6V 240V 40 Watt	£3	7	6
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750 x 750V 750mA	£7	10	0
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Used Headphones, as above. Tested. Perfect order.

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Regulated. Filtered. 125V DC.

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8-day movement. Cost Govt.	£28
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Standard or miniature to suit all valves.

Coils B/C 455 KC	9/6
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GENEMOTORS

Input	Output				
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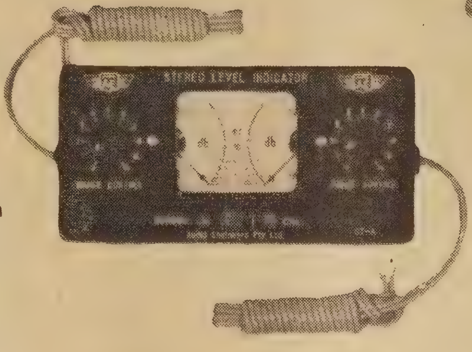

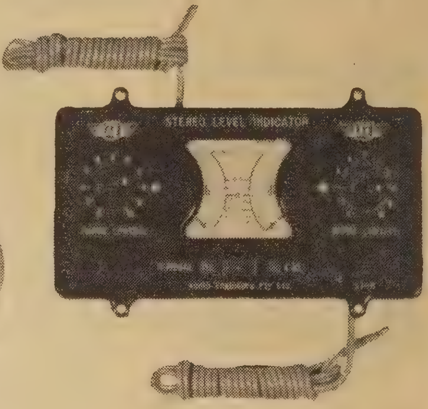

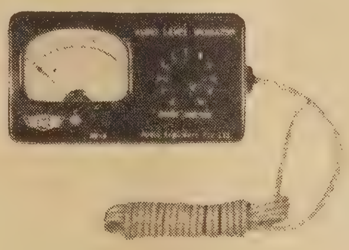

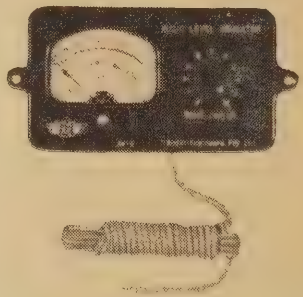

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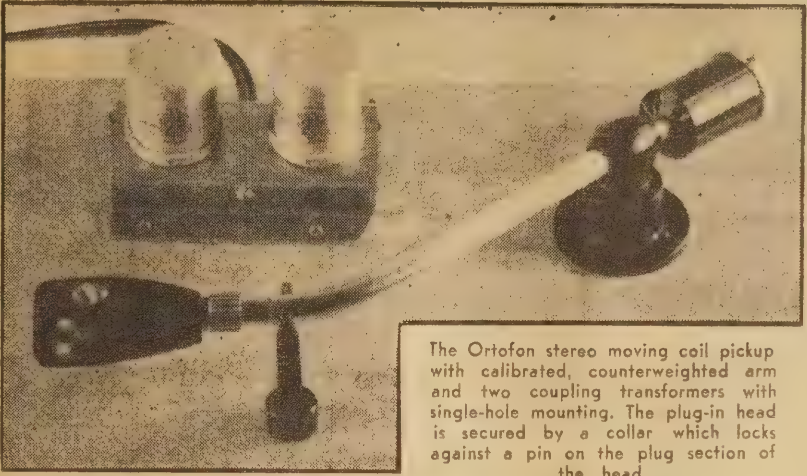
TRADE REVIEWS AND RELEASES



The Ortofon stereo moving coil pickup with calibrated, counterweighted arm and two coupling transformers with single-hole mounting. The plug-in head is secured by a collar which locks against a pin on the plug section of the head.

ORTOFON STEREO PICKUP IS AVAILABLE

Users of Ortofon pick-ups for monophonic records have been awaiting with interest the release in this country of the stereo version, for although these pick-ups are in the high-priced bracket, their performance has always been in line with the top quality one would expect.

THE stereo Ortofon, shown in the photograph above, has been subjected to exhaustive tests in measurement and use, and so far we have found it unequalled in performance.

Constructively it is really two type C movements coupled together at an angle of 45 degrees by an ambitious gymbal mounting and jewelled bearings. It is therefore more fragile than the single channel pick-ups and, as with all high-grade stereo designs, should not be roughly handled.

It comes with a new arm, counterweighted and calibrated in grams playing weight, an excellent feature, as the pressure on the point need not be greater than 2 grams or 3 at the most. Its balanced design renders it comparatively insensitive to bounce which is a disadvantage of many spring-loaded arms.

A conversion kit can also be had so that a differently shaped head can be used with the old type arm.

COUPLING TRANSFORMERS

Two coupling transformers are used to step up the extremely low output from the moving coils, so that it will play successfully into any standard stereo control unit.

Tested with a Westrex frequency disc, its response was well within the claims for plus or minus 2 db up to 15 Kc. Allowing for possible variations in testing procedure, including the disc, it can be considered as being virtually flat up to 14 Kc. At 15 Kc one of the channels showed the commencement of roll-off. The channels themselves are balanced in output within 2 db.

Resonance was almost impossible to detect, but would appear to be in the region of 12-13 Kc where a very slight rise was noticed.

Waveforms throughout were very good indeed, and not bettered by any pick-up tested to date with the exception of the monophonic type C. On a 1 Kc square wave, the small amount of ringing was again only bettered by the type C.

CLEAN QUALITY

In use the pick-up is remarkable for its clean reproduction, freedom from peaks, and superlative definition. Its separation is good over the entire range. Its maximum at about 1 Kc is better than 22 db, which is adequate for playback use.

The arm is well engineered, with adjustable height at the base.

The price, including two transformers, is £75/18/ retail.

THE LEAK STEREO POINT ONE CONTROL UNIT IS FLEXIBLE

Handsome appearance, good performance, and great flexibility are the main features of the Leak Point One Stereo Control unit, which, as the illustration shows, is also most attractively styled in brown and gold. It can be used successfully with any amplifier with an input sensitivity of about 200 mv.

OUR tests with this unit were made in conjunction with an Ortofon pick-up coupled into the 10-watt stereo amplifier recently described in the magazine.

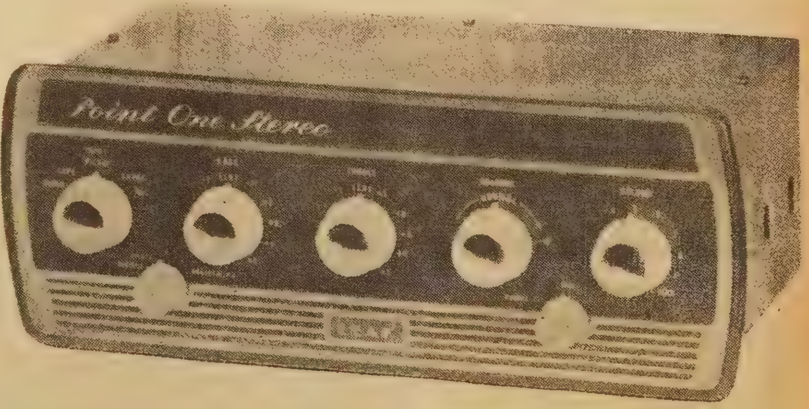
At the rear of the unit are a variety of input connectors, all for stereo, including two pick-up channels, microphone and tape channels, and initial gain controls for the pick-up channels to allow for different variations in input.

The panel controls, which have white, gold-centred knobs, include bass and treble controls with a wide variation either way, a balance control, ganged volume, and input selector.

There are two smaller knobs, one of which provides a reversal of input channels, right or left only, and a parallel connection marked monaural. The other is a rumble filter which attenuates response at the extreme low end for use if needed.

The circuit uses the conventional Leak feedback method of tone control, and there are two EF86 valves in each channel. Power supply is taken from the amplifier at a nominal 190 volts.

The unit is very pleasant to use, able to accommodate any type of input, and looks extremely well when mounted. Even when fully opened up, the valve hiss is no more than must be expected from such a high-gain arrangement.



The Leak Point One stereo control unit operates well, is attractively styled, and has continuously variable tone controls

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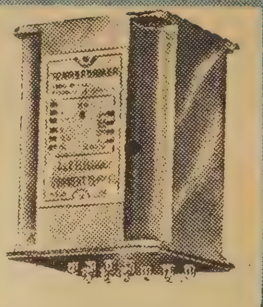

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Mullard 5/20 Amplifier .. -- --	Type 4001-8 4001-15

For full details see below.

MEDIUM FIDELITY

See Valve Chart	Type	Watts Rating	Impedance (ohms) Primary	Secondary
A	928	5	7,000, 5,000 S.E.	15. 12.5, 8, 3.7, 2
B	932	7	10.000 P.P.	15. 12.5, 8. 3.7, 2
C	929	10	4,000, 2.500, S.E.	15, 12.5, 8, 3.7, 2
C	930	10	4,000, 2,500, S.E.	500, 250, 125.
—	809	15	500 (Line)	15. 12.5. 8, 3.7, 2.
D	914	15	5,000, 3.000 P.P	500. 250, 166. 125, 100.
D	915	15	5,000, 3,000 P.P	15, 12.5, 8, 3.7, 2.
E	917	15	10,000, 8,000 P.P	500, 250. 166, 125, 100
E	918	15	10,000, 8,000 P P.	15, 12.5, 8, 3.7. 2.
F	922	25	8,000 P.P.	500. 250. 166. 125, 100
F	891	35	6,600 P.P.	500. 250, 166, 125, 100,
G	892	55	3.200 P.P.	500, 250, 125, 83, 62, 50

HIGH FIDELITY

See Valve Chart	Type	Watts Rating	Impedance (ohms) Primary	Secondary
	933	3	5,000 P.P.	15, 8, 3.7, 2.
H	870	6	10,000 P.P.	2 or 8
	2,525-8	10	8,000 P.P.	2 or 8
	2,525-15	10	8.000 P.P.	3.7 or 15
J	871	12	10.000 P.P.	2 or 8
J	872	12	10.000 P.P.	3.7 or 15
D	763	15	5.000 3.000 P.P.	15, 12.5, 8, 3.7, 2.
E	896	15	10,000, 8,000 P.P.	15, 12.5, 8, 3.7, 2.
E	897	15	10,000, 8.000 P.P.	500, 250, 166, 125, 100.
D	920	15	5,000 3,000 P.P.	500, 250, 166, 125, 100.

HIGH FIDELITY —*Ultra Linear*

Screen Taps 19% of Plate Impedance—43% Turns

See Valve Chart	Type	Watts Rating	Impedance (ohms) Primary	Secondary
K	949	12	8,000 P.P.	15, 12.5, 8, 3.7, 2.
L	916-8	12	8.500 P.P.	2 or 8
L	916-15	12	8.500 P.P.	3.7 or 15
M	921-8	20	6.600 P.P.	2 or 8
M	921-15	20	6.600 P.P.	3.7 or 15
N	931-8	20	4,500 P.P.	2 or 8
N	931-15	20	4,500 P.P	3 7 or 15

HIGH FIDELITY —*Ultra Linear*

Screen Taps 19% of Plate Impedance—43% Turns

† ON GRAIN-ORIENTED CORES

	Type	Watts Rating	Impedance (ohms) Primary	Secondary
	2,540-8	10	8,000 P.P.	2 or 8
	2,540-15	10	8,000 P.P.	3.7 or 15
†	4,000-8	10	8,000 P.P.	2 or 8
†	4,000-15	10	8,000 P.P.	3.7 or 15
†	4,001-8	20	6.600 P.P.	2 or 8
†	4,001-15	20	6,600 P.P	3.7 or 15

VALVE CHART

	FOR USE WITH VALVE TYPES
A	6V6, 6BW6, KT61, 6M5, EL84, etc.
B	6BM8. Use in "R.T.V. and H.," "Low Cost Crystal Amp" and Subsequent 6BM8 Circuits
C	KT66. 6L6. 807, EL37, etc.
D	2A3, 6A3, 6AS7G, etc., in Class A or ABI.
E	6V6GT, 6BW6, 6M5, KT66, etc., in Class A or ABI.
F	6L6G, 807, KT66, etc., in Class ABI,

	FOR USE WITH VALVE TYPES
G	6L6G, 807, EL34, EL37, etc., in Class AB2.
H	6V6GT, 6BW6, 807, etc. as Triodes in Class A.
J	6L6G 807, KT66, etc., in Class A.
K	6V6, 6BW6, KT61, EL84, etc.
L	6V6, 6BW6, KT61, etc.
M	807, KT66, EL34, etc.
N	6L6, EL37, KT66, etc.

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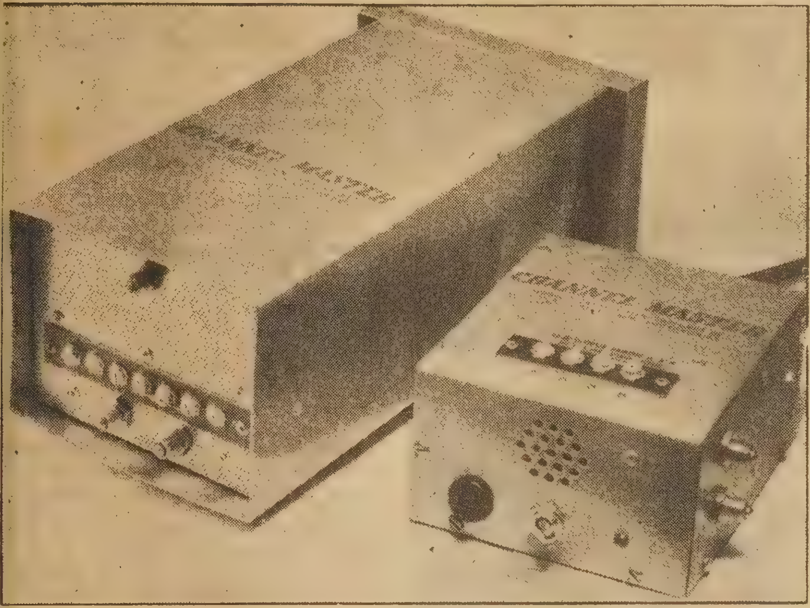


The mast-head amplifier on the left and power spply unit on the right.

A television mast-head amplifier, currently available from Channel Master Pty. Ltd. will be of special interest to viewers in difficult or in fringe areas or to radio dealers wishing to feed signals simultaneously to a number of display receivers.

THE unit contains two broadly tuned units which between them cover channels 1 to 10.

One amplifier contains two 6BQ7A as cascode RF amplifiers, followed by a 6AK5 pentode. This amplifies the higher frequency channels, including 7 and 9.

The second amplifier contains one 6BQCA cascode and a 6CB6 pentode amplifies the lower channels, including channel 2.

The input to each amplifier chain is brought out to separate terminals which can be fed, if maximum performance is required, from separate high-band and low-band arrays. The output from the amplifiers is brought together, however, so that connection between the mast-head amplifier and the receiver can be effected with a simple coaxial cable.

Where conditions are less exacting, the amplifier input systems can be paralleled as well and fed from a single all-band array.

The manufacturers quote a gain of 25db over the level of signal picked by the aerial.

Normal procedure is to mount the amplifier unit on the mast, immediately below the aerial system and, to give access for occasional inspection or service, the mast should be capable of being lowered or else be a climbable type.

Depending on the type of cable used, the aerial and amplifier can be located up to a thousand feet from the receiver which it serves.

Power for the amplifier is fed to it along the same cable which transmits the RF signal. A power unit box near the receiver isolates the RF signal for connection to the receiver and also steps the mains voltage down to 32 or thereabouts to supply the distant amplifier.

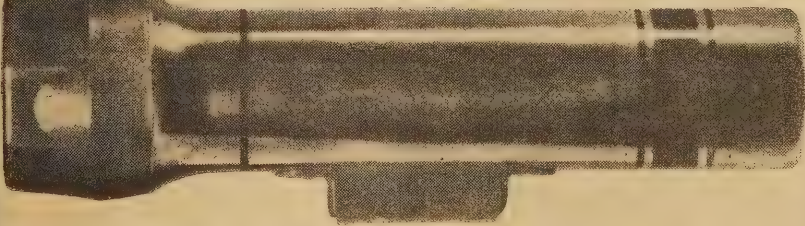
Tappings are provided so that the supply voltage can be adjusted to balance the anticipated voltage drop along the supply line.

The case of the amplifier proper is cadmium dichromate plated and finished in grey hammertone, so that it should be effectively rust-proofed. It is shaped to keep out rain but not otherwise sealed. The manufacturers point out that, in adverse conditions, the amplifier can well be left on, its own natural temperature providing excellent insurance against internal moisture.

In many locations it may be preferable to mount the amplifier unit at the foot of the mast, where it can be separately housed and protected against corrosive fumes. This procedure could well be adopted atop city buildings.

For further information, contact Channel Master Pty. Ltd., 752 Pittwater Road, Brookvale, N.S.W.

A NOVEL TORCH FROM EVEREADY



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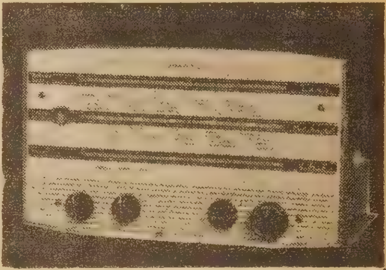

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Which Loud Speaker for Stereo?

Should the speakers be separated or in a single cabinet? Must they be identical? Can the bass be confined to a single speaker? In this article, one of the foremost technical writers of the day gives his views on these and other stereo matters.

By NORMAN CROWHURST

In practice, speaker arrangements have to be made to suit circumstances. But they should be separated if possible.

STEREO is big news these days and naturally everyone wants a piece of the cake. The gimmick artists are well in evidence. This is a pity, because stereo can get quite confusing enough if we stick to the strictly legitimate end.

"Hear your hi-fi in three dimensions!" is the substance of some stereo promotion which carries the implication that, until now, our poor little ears must have been struggling along in only two, or that we have been using only one ear! The fact is that, for two-eared people, listening has been a stereophonic experience from birth. So what do we really expect stereophonic sound to add to high fidelity?

WHAT STEREO DOES

This is the first thing we should get straight. It will help us a lot in understanding how to pick and use the loudspeakers to get the best from stereo program material. Single-channel high fidelity, nowadays called monaural (which admittedly is not a good name because it means one-eared) or monophonic, has the limitation that an original performance occupying four dimensions (waves in three dimensional space and time) must be compressed into two (magnitude of fluctuation with time) for recording and transmission. This must lose some of its identity, although the reproducer puts it back in four dimensions again. But it is impossible, from the limited data that can be conveyed in a two-dimensional channel, to reconstitute the original with four-dimensional precision.

Our hearing faculty has acquired the capacity to give us a quite accurate impression of the four-dimensional events going on around us from an analysis of the two two-dimensional channels, one received by each ear. But analysis and synthesis are different things.

Our hearing faculty can give a wonderful sound picture of the world around us from this analysis; but it would be quite impossible to use this two-channel transmitted sound picture to recreate the world of sound: a dummy head with the most complex electronic in the world could not produce the noise of an aircraft 5,000ft up. Nor can two loud speakers project an orchestra. Thi idealised concept of stereo is certainl based on a fallacy.

The viewpoint that is more successfu as an approach to stereo is that conveying the total sound on two channel gives us twice the potential that one doe for achieving a realistic illusion. In particular, this potential lies specifically i the improvement of perspective.

TWO BASIC CHANNELS

So we should visualise stereo as a system in which basically we have twc channels instead of one used in mono This may be obvious but it is the onl thing which is basic in stereo. Beyonc these two channels, the success of the illusion depends on what is done at thei two ends; the microphone and the recording technique at the input; and the playback and loudspeaker arrangement at the output.

Each of these variables provides the possibility for a wide variety of combinations. Microphones with at least three variations in directivity can be used in any number and placement, and thei output combined in different ways to produce the final two stereo channels There is an almost similar range of possibility for variation in the use of loudspeakers.

But we've said enough to show tha stereo is not the simple thing some theorists have suggested. Instead of proceeding further on how complicated i can get, let's deal with some specific questions.

1. Some recommend a stereo system with two loudspeaker systems in a singl enclosure, while others insist stereo ca only be obtained with two speaker spaced apart along a wall. Which is best?

This depends. Each can be "best" i circumstances suited to it. Probabl most important of these is room size.

In a small room it is practically impossible to find more than a very smal listening area where one is not muc nearer to one speaker than the other, i spaced units are used. (Fig. 1A). B using a single enclosure system, all part of the room are at a commensurate distance from the two loud-speakers (Fig 1B) and the stereo pattern is created i any location by the transverse component of the sound wave, caused by th **difference** in radiation from the tw units (Fig. 3).

SPEAKER COVERAGE

But in larger rooms the relative meri is almost exactly reversed. The transverse component of the wave only hold a reasonable strength for a very smal distance from the composite loudspeake system, so the successful listening are will be confined to a narrow line dow he middle and a slight enlargement right t the front (Fig. 2A).

On the other hand, the larger room dimensions enable spaced speakers to “push out” the stereo effect further and nly comparatively small areas of the oom are now uncomfortably close to ne speaker (Fig. 2B).

A secondary factor is the way the rogram was miked. This may be a eciding factor in medium-sized rooms—ay about 15ft by 20ft or a little larger.

The hearing faculty bases its analysis n the time difference of various sound omponents in the compositive wave **eaching each ear.** But to maintain this orrect time difference, without exaggerating or reducing it, proper proportion ust be kept between time and intensity ifferences.

If widely spaced mikes are used for ickup, combined with widely spaced oudspeakers for playback, the time difference is going to get exaggerated at ome listening locations in the room to he point where an echo, or double nage, rather than perspective, results. his would be particularly pronounced n material such as strings played pizzicato.

TIME AND INTENSITY

On the other hand, if time difference n the channels is small and intensity ifference has been accentuated, either y using directional mikes close together ut facing different directions or by using ectronic mixing of mikes close in to dividual instruments, the “projection” f the stereo illusion will be strictly a unction of speaker spacing to “create” a me difference at the listener's ears.

Thus, within certain room size limitaons, program made with a wide-spaced ike technique should use loudspeakers ose together (in one cabinet) while proam that used close-together (direconal) mikes should be reproduced on idely spaced loudspeakers.

2. Different, and quite conflicting, atements have been made about the ontribution made by various parts of e audio spectrum to the stereo illuon. Just what are the important stereo” frequencies?

Unfortunately, a lot of work has been ne using continuous steady tones, ther fed through headphones or using ultiple loudspeakers. From these exriments various deductions have been ade as to the dependence of our sense direction on intensity and phase difrences at different frequencies. The deuctions conflict because of different easurement techniques.

RANSIENTS

However, other work shows that these sults are not relevant to the stereo illuon perceived on “live” sounds.

A particularly effective demonstration this fact occurred in work with the rspecta system of stereo for theatres. for example, the initial beat of a um is accurately located by the stereo usion, it is practically impossible to l that the follow-through “oing” shifts ar across stage, **even when you know does.**

This is equally true of other types of und. Only sounds generating trannt components continuously, such as eech or a succession of different notes ng played, enables a moving source be followed. A tone containing repetitive sharp transients, such as an aircraft motor, will also make this possible.

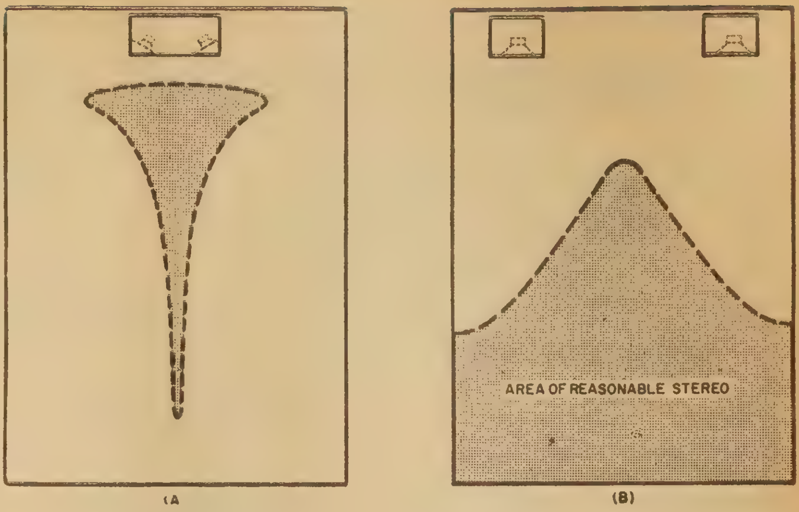

Fig. 1. Spaced speakers in a small room (A) may restrict the area of acceptable stereo. The composite system in a single enclosure (B) may do a better job here.

The hearing faculty seems to identify the direction of the **composite** transient, rather than of individual **frequencies** it contains. If the time difference is identical for all these component frequencies, then the sense of “integrity,” both of position and the sound itself, is improved.

But what does this mean, as applied to reproducers for stereo? The difference in conclusion largely concerns the higher frequencies, from 1000 or 1500 cycles up. It occurs because different methods are used to “generate” the right differences at the ears of the listener.

With the wide-spaced loudspeakers, difference in intensity of radiated sound produces a time difference at the ears, due to the obstacle effect of the head, that depends on frequency. At higher frequencies the difference is likely to be altogether greater than for lower frequencies, invalidating a proper association of the high-frequency components with the lower ones. So with this arrangement, it is not surprising that critical tests show that the very-high-frequency components do not contribute anything to the stereo illusion.

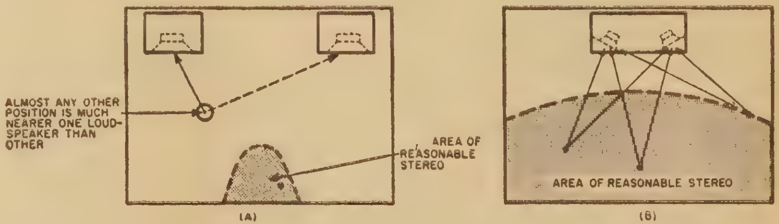
ALMOST ANY OTHER POSITION IS MUCH NEARER ONE LOUDSPEAKER THAN OTHER
AREA OF REASONABLE STEREO
(A)
AREA OF REASONABLE STEREO
(B)

Fig. 2. Composite system (A) may be limited in coverage of larger room. Spaced speakers (B) may do a better job here.

With speakers close together, and employing directional radiation, the higher frequency contribution to the stereo illusion is due to the precedence effect. A speaker directly facing the listener, and having the greater intensity, will localise itself as the source. If the higher frequencies come from the other speaker in greater intensity, however, the source will be delocalised and the hearing faculty will associate, by comparison, these components with the lower frequencies to which they belong. Thus use of a different type of speaker enables the higher frequencies to contribute a useful part to the stereo illusion.

3. What about the statement that the same loudspeakers used on stereo show an improved frequency response?

Common sense urges that this cannot be so—how can a loudspeaker “know” whether it is handling mono or stereo? And yet people who have experimented with it swear they can hear the difference.

Extension of apparent range at the low end is relatively simple and there is little argument about it. Two units, even on the same program, will put out more bass than one, other things being equal. The same improvement in this direction naturally shows up on stereo. But this cannot be the reason at the high end.

Did you ever hear any audio components above 4,000 or 5,000 cycles? You've heard background hiss in this range and you've heard the improved clarity of certain instruments when this range is there, compared with when it is missing. But have you heard those components by themselves? This is the answer. You identify presence of these frequencies by the improved clarity they bring to individual instruments you could hear without them.

Stereo also does this, by a different means. It improves clarity of individual instruments by giving them separate localisation. And because both effects serve the same purpose to the hearing faculty—improved clarity—it takes an unusually well-educated hearing to de-

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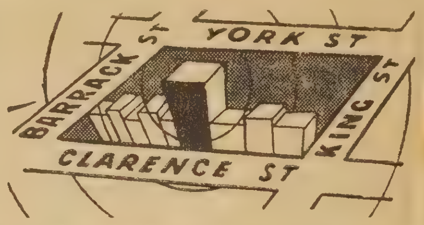

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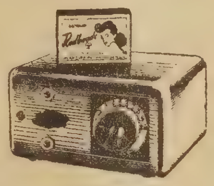

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ect the difference. A definite illusion
f improved high-frequency response—
s we have become familiar with it—is
btained.

*4. What about the idea of using one
peaker for all the bass with separate
peakers for treble?*

Some say this can be done—in fact
hey do it, while others say separation
f the lower frequencies into the two
hannels is definitely necessary to stereo.
'his question hinges on "lower than
hat?" What crossover is used? I asked
ne speaker manufacturer who took the
econd viewpoint what crossover he used.
Ie had only tried it with one of his
egular units, using his regular cross-
ver at a frequency of 1,000 cycles.

There's your answer. The people who
o it successfully use a crossover of 250
ycles—two octaves lower—or at the
ighest 400 cycles. This makes a tre-
endous difference. At 250 cycles the
avelength of sound in air is more than
ft; at 1,000 cycles it is only just over
ft.

LOWER FREQUENCIES

At frequencies far below 250 cycles
hich in theory may be marginal, but
ose who use it have checked that it
a satisfactory transition point) the fre-
uency content of both stereo channels
not only sensibly in-phase, there can
lso be little difference in intensity. So
o noticeable "error" is involved by
putting the two together."

"But how about transients?" I have
een asked. Now just what is a low-
equency transient? Some visualise a low
equency, below 250 cycles, that starts
bruptly. But a low-pass filter, rolling
ff at 250 cycles, will not allow such an
brupt start. If a 250-cycle tone is keyed
n, or started with a blast, this start will
ontain a range of components above
50 cycles, not below it. And the click.
r burst, associated with the com-
encement of the 250-cycle tone, will
lentify its location quite successfully,
ven though the body of sound always
omes from the centre loudspeaker!

At one demonstration of a common
ass system, I went to within about 2ft
f one of the small speakers (they were
ver 20ft apart) before my ears could
ll the bass was coming from some-
here else. So it definitely works—at
at frequency.

*5. When a centre speaker is used for
ommon-bass, with side stereo speakers,
n some of both channels also be com-
ined and fed to the centre location, to
ive "centre fill?"*

INGLE BASS SPEAKER

This is a "loaded" question. A paper
esented by C.B.S. Labs at the A.E.S.
onvention stated that using any
ch centre fill would destroy proper
ereo, while the Stephens "Stereodot"
stem actually mixes program from
th side channels to feed to the centre

But a closer look shows there is good
ason for the apparent contradiction.
e C.B.S. system—and they only said
is in reference to that system—uses
at they term an Isophonic loud-
eaker for the side locations. This is
small unit mounted on an open baffle.
inting inwards at an angle of 60 de-
ees (Fig. 4). For aesthetic purposes it
housed in an enclosure that makes it
ok as if it points toward the front.
This system, above 250 cycles, uses

Fig. 4. Coverage claimed for CBS "Isophonic" system.

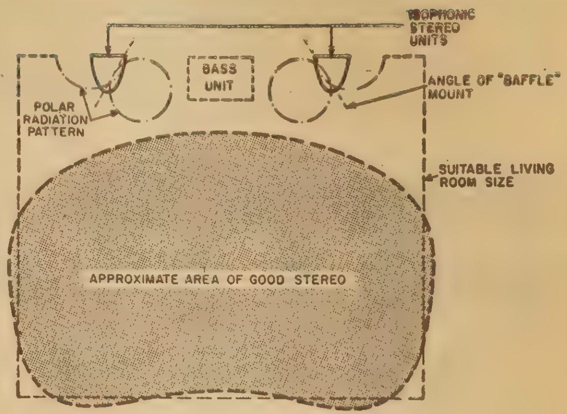
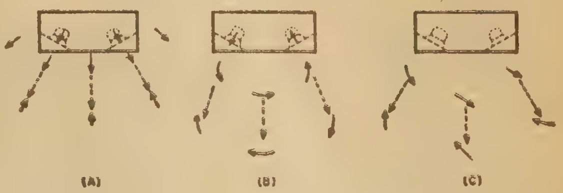


Fig. 3. Synthesis of radiation with both units in-phase (A), out-of-phase (B), and when radiation represents a source to extreme left (C). Solid arrows are instantaneous motion due to sound wave; broken arrows are used to represent the progress of the sound waves in their composite development.



the special shaped radiation pattern produced by the open-backed speaker (a figure of 8, of which only part of the front "lobe" is used). Correct sense of "location," in this system, depends on the way the radiation from just the two side "Isophonic" speakers combines. So use of a centre fill unit would upset this combination.

"Stereodot," like some systems recommended by other manufacturers, uses small "pressurised" units (with sealed backs) for the side speakers, above the common-bass crossover frequency. This far, the system is conventional, and quite different from the special distribution pattern of the C.B.S. Labs system. So it will no more invalidate stereo to use centre fill here than it does in any basic two-speaker stereo system, such as the Klipsch "Heresy."

I didn't want to mention names in this part of the article, but it seemed unavoidable here. However, my reason for using this information is that it illustrates how using a different type of loudspeaker radiation pattern can completely change things.

6. Some have asserted that a basic requirement for good stereo is an omnidirectional loudspeaker, while others deliberately use the directional characteristics of loudspeakers to obtain "best stereo effect." Which is best?

The basis for this difference has already been touched on in answer to the previous questions. The second par of this article will go into more detail about actual systems. But the basic facts we can state here.

When the two stereo speaker system are contained in the same cabinet (o are that close together), the radiation of the middle and upper frequencies must be directional for successful stereo. On the other hand, with a certain so-called "ideal" spacing for stereo speakers (which depends on room size, incidentally), best results will be obtained if the units are diffused to the point of an omnidirectional radiation.

But when you don't have a room that suits this "ideal," it needs individual consideration for its particular needs.

— by arrangement Radio & TV News

NEW TV TUBE HAS BUILT-IN SAFETY GLASS

AMERICAN TV receiver manufacturers are now reviewing samples of a new 23in picture tube by Sylvania Electric Products, Inc. The tube manufacturer reports several features for this latest CRT that may make it more desirable than those now in use.

To the technician, the most noteworthy feature of this 110-degree tube may be the fact that the panel of safety glass, normally installed as a separate item on the cabinet directly in front of the CRT, is an integral part of the "bonded-shield" design, being affixed to the faceplate. Since a separate glass will not be necessary, elimination of the dead space normally allowed between tube and safety glass will enable manufacturers to make their cabinets even shallower than has become possible in recent years.

With this innovation, the problem of removing the safety glass (or the greater annoyance of taking the chassis entirely out of the cabinet, as is often necessary) to clean away the films of dust electrostatically picked up on the rear of the safety glass and the CRT faceplate, is eliminated. In fact the set owner can now handle the job himself, if he wishes. Also benefiting the set owner is the reduction in glass surfaces present. This cuts down undesirable reflections from sidelights, resulting in clearer pictures with increased light output.

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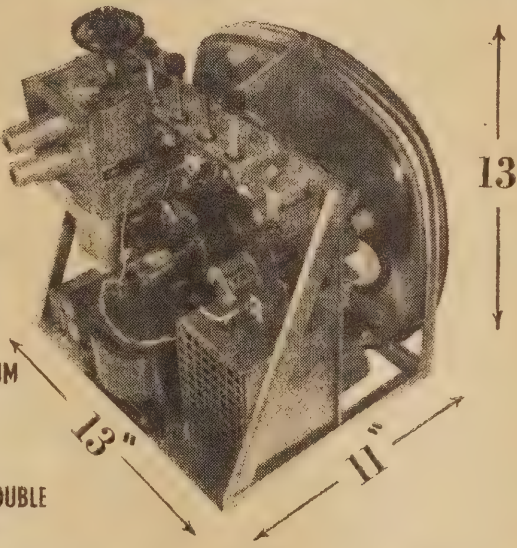

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OFF THE RECORD — NEWS & REVIEWS

During the last few weeks I have been particularly interested during my spare time in making some observations on stereo pick-ups. There are now a reasonable number of all types to use as means of gaining a general performance picture.

CANNOT say at the moment that the results of my experiments have been mpletely conclusive, except to indicate at there is still a good deal of work be done, particularly in the high ality field, before we can buy a really od pick-up at a reasonable price.

In general, I think I can say that the es of pick-ups which in their L.P. rsions were the best, are still the best stereo.

The necessity to allow vertical as well lateral movement of the stylus has ade the task of the pick-up designer ore difficult, but it has not brought out any appreciable reversals of form the performance field.

One thing which must be quite obvious now is that, without a cheap and od crystal pick-up design, the stereo c might just as well not have been oduced.

ERAMICS PROMISING

No other type—and, in the crystal ss, I would place the ceramics—looks e producing as good a response, separation and high output at a low price.

In fact, I'm inclined to believe that, some method of making a ceramic n be devised which will give a smooth d flat response to about 12 Kc, with asonable output and high compliance, ly special users would worry about ything else.

As it is, the crystals, in several wellown makes, are so good for the avere man that, remembering the very at difference in price, we might well nder if it is worth the extra cost unless is very fussy and reasonably affluent.

My impression is that, pound for und, the modern crystal stereo cartge is a better buy than its mono nterpart.

All the stereo cartridges I have tested far sounded very good, although not good as the best moving coils and gnetics.

ORK-HORSE CRYSTALS

Be that as it may, I feel there is no son why the crystal or ceramic stereo tridges should not continue as the rk-horses for stereo as they have been L.P.s and 78s.

We just couldn't get along without m.

The stylus position still isn't altogether ar in the minds of many, and frankly like to have more experience in ring out a few to form hard and fast nions. Unfortunately, so far, I have been able to wear out the sapphires, maybe there is some lesson to be ned from this.

think it's safe enough to say that preferred type of stereo pick-up is which has the lightest stylus pressure, which therefore can be operated about 3 grammes. Such a pick-up ld have very high compliances, and iamond stylus should have a very life between replacements. It would be eminently suitable for a .5 mil stylus, and should therefore have the best potential in the hi-fi field.

Today it is a very scarce animal!

But for pick-ups with any greater stylus weight, particularly if they are to be used consistently for mono records as well, the .7 mil stylus seems to be well worth considering.

The danger with the .5 mil stylus is that, either because the applied pressure is too great or because record grooves are not accurately enough controlled, the stylus tip may rest on the bottom of the groove, resulting in high noise level, poor reproduction, high stylus wear, and an unsatisfactory result.

It is the best for really lightweight, high quality pick-ups where the best possible tracing is required.

Undoubtedly it will follow the record grooves better than will a .7 mil stylus, sufficiently so for the keen ear to notice the difference on good equipment.

Any stylus pressure above 4-5 grammes seems to indicate the larger stylus point, in which the very high pressures per square inch are distributed over a larger area. This is really their only virtue, and the Americans, at least, seem to think it a worthwhile one.

STYLUS DIAMETERS

So much so that only the highest quality pick-ups specify a .5 mil point, and some of these have it only as an alternative.

For record-changers, and the low-medium priced stereo outfits which have fairly elementary, spring-loaded arms and rather high stylus pressures, I don't think it wise to consider anything but a .7 mil stylus.

Even so, if it is a sapphire, and you play it constantly, the stylus should be checked for possible replacement every few weeks.

by John Moyle

Do not get into the habit of thinking of it as a permanent point.

Perhaps I am stressing this matter rather strongly, but in the interests of all concerned, I believe it is important.

Reverting to the testing of pick-ups, I am even more aware of how difficult it is to test a pick-up adequately, particularly a good one in which deviations from near-perfection are small.

Outside a laboratory there is no easy way to test a pick-up other than playing a record with it. And, despite the care which is taken to produce and stamp test records, experience has shown considerable variation even between records of one make.

So far I have checked pick-ups with several different stereo discs which I managed to acquire and only one of these has been sufficiently consistent for me to accept it as being a near standard.

To record, process and stamp out test discs containing perfect sine-waves over a frequency range of 30 cycles to 15 Kc or more is no mean feat. To make one which will give perfect patterns on all kinds of styli, even those within the upper and lower tolerances, is virtually impossible.

RECORDS VARY

Any worker with pick-ups knows the shock he gets when he changes from one disc to another when making frequency runs. He often finds peaks where he is sure there are none, and odd-looking wave-forms where with the first disc everything looked fine.

It is therefore probably true to say that no test disc can give a very accurate picture of a pick-up's performance, as it is likely to have too many errors in its own makeup.

The first and last copies from a single stamper, for instance, must have groove shape differences which can affect waveform and level. Slight deformations during pressing can have a similar effect, while the disc which gives a constant output from the start to finish of individual frequency bands is a rarity.

After a wide range of pick-ups has been run over a given disc it becomes easier to detect any variations in the disc itself. These will be repeated no matter what the pick-up, and they can be extracted by inspection of the final results, although not with great accuracy. With stereo discs there is a further hazard, for, although when examining each channel separately there is an apparently silent channel opposite, this quiet side must carry some modulation. Otherwise it implies the perfect cutting head, which we know must have some cross talk of its own.

SEPARATION

Channel separation on most cutting heads is fairly good, but it doesn't take very much cross talk to affect the signal being examined by quite a few per cent, and often enough to affect the waveform.

A striking example of this may be found by playing a stereo pick-up with a lateral test disc and noting the difference in recovered wave-form when the two channels are wired in parallel as against testing them separately.

The improvement in wave-form which takes place when the parallel connection is made will amaze you.

For all these and other reasons channel separation seems to be very risky to check with such discs.

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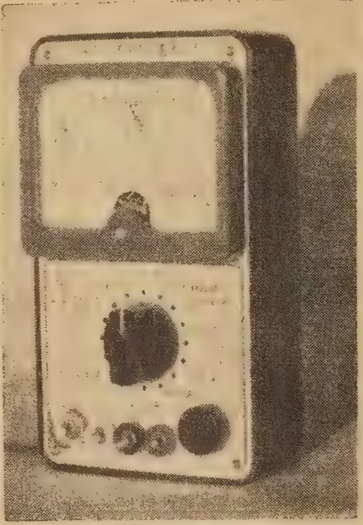

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. It does not seem valid to assume that, ven when the opposite side of a groove arries what is supposed to be part of he same signal, the displacements conerned are completely in phase with each ther.

If a certain separation figure is obained from a suitable test disc it might e safe to assume that it represents a ninimum degree of separation, but the naximum or actual figure might be up o 50 per cent greater than that indiated.

From observations it looks as though measured separation of 15 to 20 db is robably enough for all practical puroses, although many pick-ups can xceed this figure.

One severe test I use is to play back 1 Kc square wave pattern on a record have.

Even a perfect pick-up wouldn't play ack a perfect square, for the original utting head had its own ringing patrns which the disc has recorded.

They are, however, well damped, and is easy to pick the regular overshoot nd ringing patterns from resonances in e pick-ups themselves.

By a process of extracting what useful information can be gleaned from such tests it is possible to get a fairly good picture of performance, particularly on a comparative basis, although the percentage of error we are forced to accept because of the limits of the measuring methods is far greater than we would dream of allowing when testing an amplifier itself.

A little later it might be possible to classify some of these results into some useful comments.

So far the most interesting stereo cartridge I have had can actually play not-too-hard discs with a pressure of only one gramme.

Concerning pick-up arms it's a pity more manufacturers do not use counterweighting instead of spring pressure adjustments.

The fact that a counter-weighted arm is balanced about its pivot makes it much less susceptible to bouncing when you shake the floor with a heavy footstep.

Conversely, without special damping, spring-loaded arms can be a nuisance in this respect.

RECORD REVIEWS FOR THE MONTH

SUN AND SHADOW — The Music of Spain. Fourteen numbers by Lucio Milena and his Orchestra. Coronet KLP 751.

Small group bands represent a field which some of the very best recordgs are made.

It is a big step towards this end when is possible to handle individuals and ctions with their own microphones, ith or without artificial reverberation d every gimmick to help produce articial sound.

It is all the more striking because the rger-than-life result just couldn't be ard or duplicated in actual listening. his kind of super sound exists as a rtual disc or tape exclusive.

The record is a very good example what I mean, but not an extreme one. Its character leads me to believe it s been or will be released for stereo, d it should be even better that way. Otherwise I feel it would have been uch more closely miked with a sharper lance and more immediate sound at ch end of the scale.

As it is, reverberation is pronounced, rticularly in numbers such as Danza l Molinero, and the effects are mostly e result of mixing techniques.

The star instrument is the saxophone, ich is heard in frequent and effecely played solos.

The arrangements are bright and witb propriate colour.

On my copy the surface was inaudible d of its type I thought it a terrific rerding.

★ ★ ★

GYORGY CZIFFRA — playing his own Paraphrases, Transcriptions and Improvisations. HMV OALP 1604.

One can only hear pianistic technique this nature with awed amazement.

It seems impossible that human gers should move so fast and for so g.

My head began to reel about halfway ough the first side.

So if you are looking for things like Bumble Bee and Sabre Dance played with inhuman ease and power you need not look or read any further.

I frankly wonder whether this dazzling display does very much for many items and, in fact, whether it is really necessary at all.

So much emphasis is placed on sheer technique that it must therefore represent its own means to an end.

In order to achieve this result it is impossible to avoid a sense of the mechanical which could be improved upon by using mechanical methods to produce it.

The jacket notes invite us to accept Cziffra as a successor to Liszt as a paraphraser and improviser, but I for one cannot avoid noting a vast gap between the colourful and imaginative work of Liszt and the obvious devices with which Cziffra is almost completely taken up.

His Roumanian Fantasy and William Tell improvisations are examples of this. To my mind they are little more than pointless rhythmic meanderings with a flavour of the tunes of the type which Liszt made so memorable.

And frequently there are feats which even Cziffra finds a strain on the nervous system.

You will therefore listen to this disc with wonder rather than affection.

The recording is equal to the task of accommodating the tremendous sound peaks. But I should imagine that no pick-up would be too good to handle them, particularly at the end of the first side where the tone tends to deteriorate.

It is a colossal performance.

★ ★ ★

RIMSKY-KORSAKOV — Scheherezade. Played by the Royal Philharmonic Orchestra conducted by Sir Thomas Beecham. HMV ASD 251. (stereo.)

This is the stereo version of the monophonic disc released some time ago, and my only serious criticism is that the surface proved rather disappointing.

This of course may be a feature of the copy I have been using, and most times the orchestra is too powerful for it to be heard.

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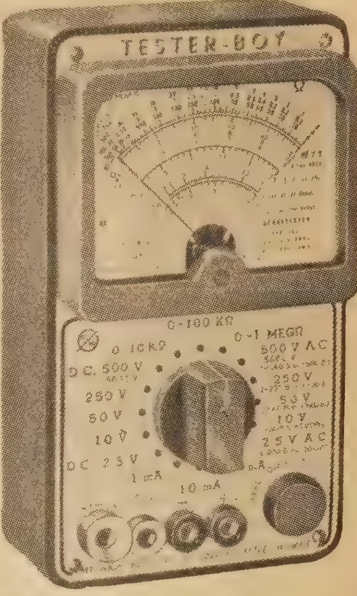

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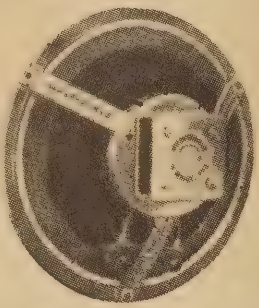

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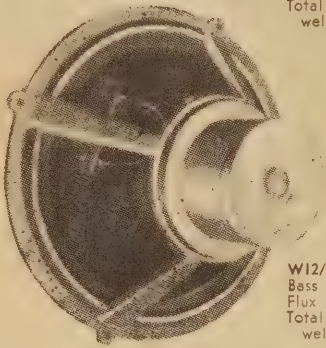

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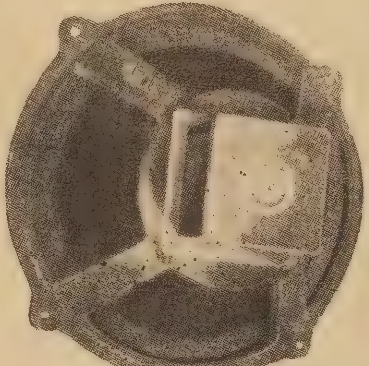

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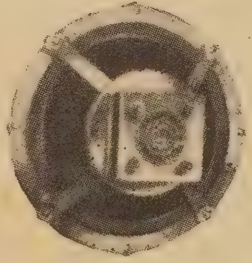

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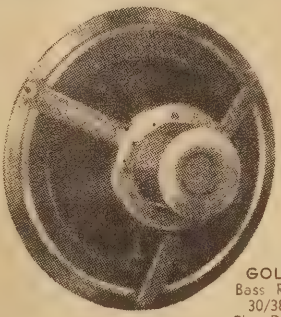

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Flux Density 14,500 gauss
Total Flux 60,000 maxwells

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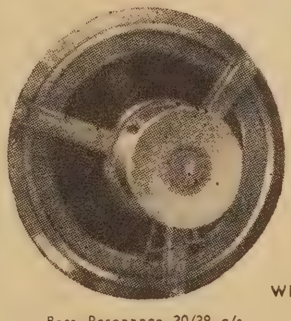

W10/FSB

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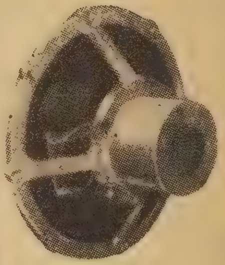
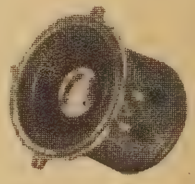
Total Flux 84,000 maxwells



SUPER 8/FS
Bass Resonance 45/55 c/s
Flux Density 14,500 gauss
Total Flux 60,000 maxwells



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Unfortunately it was most noticeable at the commencement of each side, where it must be considered an intrusion.

Having disposed of the debits first of all it is a pleasure to describe the credits in the highest terms.

Together with Decca's Petrouchka I would class it as the best stereo disc I have yet heard featuring a full orchestra.

When the orchestra is playing as a whole there is no sense at all of a gap between the speakers.

The solidity of the sound is particularly impressive in the powerful brass section where, as with Petrouchka, one becomes aware of quite subtle matters of placement both in azimuth and in depth.

And if my recommended procedure of listening in a darkened room is followed it is quite possible to lose altogether the impression that there are any speakers being used.

There seems to be no reason to doubt that records of this and even better quality will become commonplace as time goes on.

The comparison between this gorgeous noise and the sharper and wider range of the Decca sound is most absorbing to observe. I do not mean by this that there is any dullness in this disc, but it features that full-bodied sound which is partly the result of recording and partly the character of the music.

As is Beecham's habit, the playing is losely controlled and has considerable race, even to the point of being overlone. It is possible to infuse more dash vithout any danger of vulgarity. But s it is the music is truly glorious to ear.

Ignoring the surface noise, which I ervently hope is not an essential, it is nother five-star record.

★ ★ ★

STRAVINSKY — Petrouchka Ballet. Played by l'Orchestre de la Suisse Romande, conducted by Ernest Ansermet. Decca SXLA 2011 (Stereo).

Next to Boutique Fantasque, Ansernet's Petrouchka gave me my first big i-fi thrill in the early L.P. days, and nade a reputation for itself around the vorld.

I still have the original copy brought o Australia by Mr Beecher Stevens in he early days of the L.P., and even tolay it sounds well.

The new stereo version by the same rchestra and conductor has duplicated he success of its predecessor, and is as ine example of present-day stereo as ou are likely to hear.

The remarkable difference between the wo is due almost as much to the uperior recording as to stereo as such.

It has a tremendous dynamic range—uite unrestricted, I would say, when istening to those huge bursts of sound nd shattering drum beats.

Its frequency range is also of the ighest order, so much so that only on e highest quality pick-ups have I been ble to appreciate it fully at both ends f the scale.

A brilliant score such as this is ideal s a test piece, and requires the very est transient response to do it justice. his, Decca has achieved in a manner nequalled by any disc I have heard to ate.

Its instrumental definition as a result quite exceptional.

Listen particularly to the latter half f the second section, and the last part f the fourth.

If your equipment is good, you will applaud with me a really marvellous example of technical and musical combination.

Stereo, of course, adds immeasurably to the overall effect.

No effort has been made to divide instruments into channels purely for effect, although the prospect must have been tempting.

Instead, the orchestra has been placed before you as a complete and ordered entity, and you in turn will instantly be aware of the individual positioning and quality of every instrument.

This is the kind of stereo the music-lover has been waiting to hear — an enormous step forward in the illusion of reality in reproduction.

You must pardon my superlatives, but each hearing of the disc has only added to my admiration for its superb quality.

Unfortunately, wide-range equipment will probably pick out a surface rustle loud enough to be heard through many low-amplitude passages.

Sometimes I would have liked it to move less meticulously and there are a few incidents, such as the entry of the Doll into the Moor's room, which could have carried greater impact.

But these are minor points, and do not disqualify it for my five-star award. Decca will need to work hard if this standard is to be maintained.

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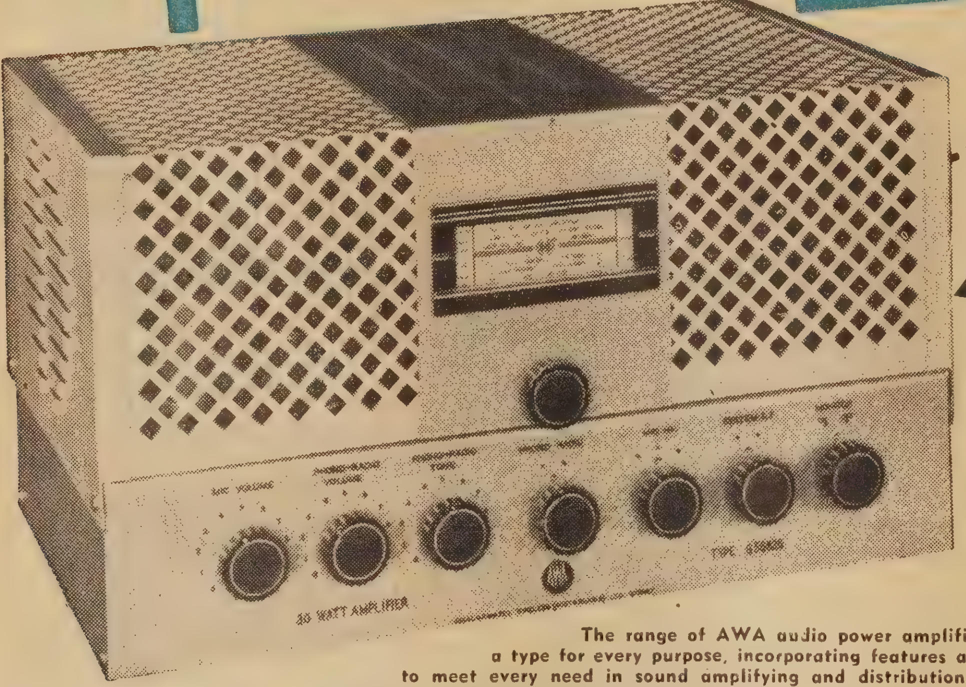

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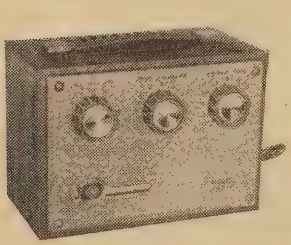

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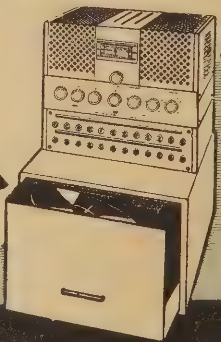

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nd the Little Orchestral Society of
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5 in D major, K385 (Haffner).
layed by the Los Angeles Sym-
hony Orchestra directed by Alfred
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his concerto is an early work of
zart—bright, graceful and uncompli-
ed. It was originally intended for per-
mance by comparatively slender
ces, and in this respect its presenta-
here is probably more authentic
n the broader versions we generally
r in a concert hall.

he lack of reverberation in the re-
ding chamber contracts the sound
further and personally I would have
d more lively acoustics.

he violinist is particularly competent
good intonation and clean technique.
Jnfortunately, although both orches-
and soloist individually are generally
d, their understanding isn't always
ain, particularly in the first move-
t, and this deadness of the sound
s nothing to help matters.

he best movement is the famous
do with which it ends. This is very
d Mozart.

he Haffner is obviously played by a
er orchestra, and although there is
velier feeling to it, the sound is rather
d and steely.

he orchestra plays well with drilled
cision, dominated by the strings which
e the quality of a single instrument
er than of many.

would have traded some of the ac-
acy for greater warmth, particularly
he last movement where the tempo
omes mechanical and the spirit lost.
he surface is quite good.

* * *

LOLA MONTEZ—Musical num-
ers by Original Elizabethan
heatre Trust Cast, including Mary
reston, Frank Wilson, Jane Martin,
lichael Cole and Alan Hopgood.
olumbia SAXO 7501 (Stereo).

his is probably the first Australian
ording in stereo, but whether it is or
it is a very good one.

doubt whether there is much point
commenting at length on the music,
ch has passed the public test with
t credit.

follows closely the successful for-
a of overseas musicals, and there is
any reason why it shouldn't.

ersonally I find it highly derivative
not particularly imaginative, but it
ll projected with great vitality and
o.

trange how the Australian "accent"
s glamour when compared with
adway and Hollywood, but we have
yet learned to accept easily theatri-
idioms centred in our own country,
have we learned to handle them
out being either self-conscious or
btle.

nd I suppose it's human nature to
vulgarities in other dialects funnier
those in our own.

Interesting, too, to note the hint of American accent which creeps in at odd times.

The singers are enthusiastic and varied, particularly the ladies of the town, who give as frank a performance as you would find anywhere.

However, the record buyer will be more interested in the sound than in my views on the music, and here he is very fortunate.

The stereo isn't of the gimmick type—on the contrary, it is very well distributed with a most convincing use of separation in the orchestra and a good feeling of placement.

The voices are well forward, often a little too much so, but they are all easy to follow, and their articulation is clear, even in the choruses.

Acoustically it has a realistic theatre atmosphere and although many of the numbers have been streamlined, anyone who has seen the show will recognise them all and fill in the byplay.

I believe the record was cut overseas from a local tape. It has plenty of amplitude and the surface noise is quite low.

A safe and interesting buy, good value by any standards.

* * *

WEBER — Grand Duo Concertant Opus 48. SCHUMANN — Phantasiestucke Opus 48. DEBUSSY Premiere Rhapsody. Played by Reginald Kell (clarinet) and Joel Rosen (piano). Festival FL-7030 (original by American Decca).

Not a great deal of music has been written for the clarinet, although it has fared better than some other orchestral instruments which are rarely if ever heard by themselves.

It's a pity, for the clarinet has many features which make it a good solo instrument, among them being a clear and interesting tone.

Of those who wrote for the clarinet, Weber is one of the most important. It was one of his favourite instruments and is used freely in his orchestral works.

He has also written several clarinet concertos, one of which is probably the most popular of all concert works for this instrument.

Weber exploits it with great understanding, skilfully using its tone-pitch variations and its adaptability for long, sweeping melodies and sustained notes.

This concertant is not as brilliant as some of the concertos. It seems less enterprising and more stylised but, like everything that Weber wrote, tuneful and gracefully put together.

The Schumann makes an interesting contrast in style and also in its use of the clarinet with less urbanity and greater introspection.

A still further contrast is supplied by the Debussy, whose employment could scarcely be more different. Here it is largely an exponent of tone, colour and mood. It shows, too, that in the 60 years since Schumann, the clarinettist was expected to handle a greater range of technical problems.

Reginald Kell's performances are in every way magnificent. He is probably still the finest player alive and the recording does him the fullest justice. It includes some of the loveliest clarinet playing I have ever heard, not merely in

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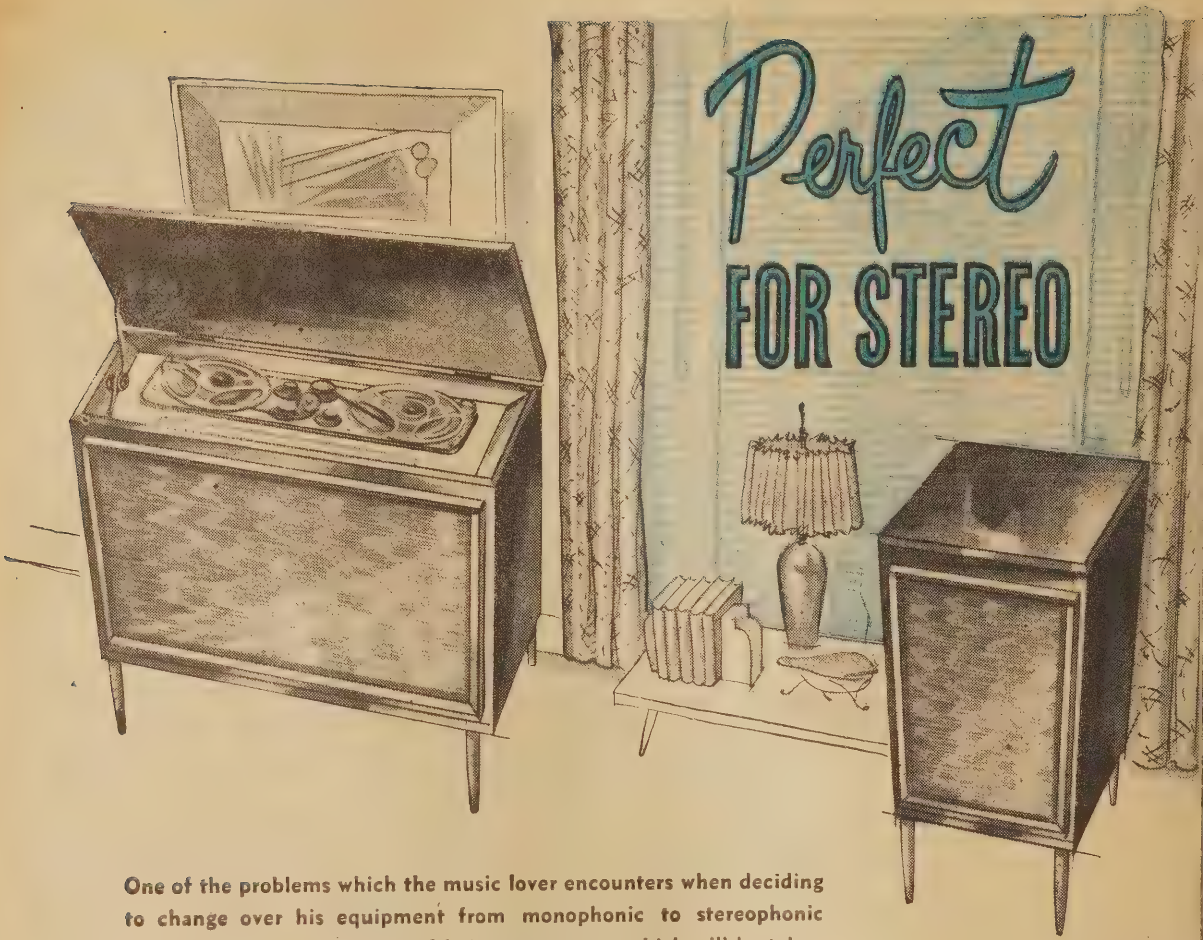
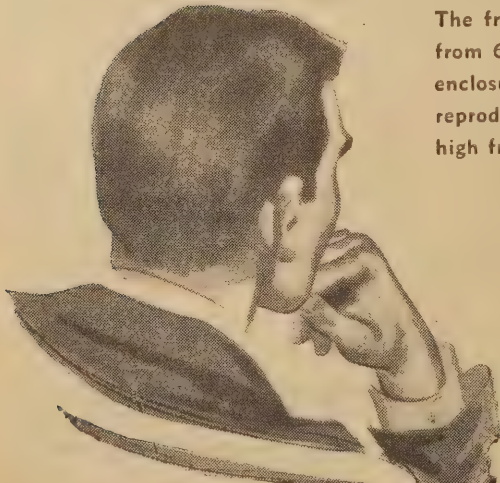


One of the problems which the music lover encounters when deciding to change over his equipment from monophonic to stereophonic reproduction is the amount of living-room space which will be taken up by an adequately baffled loudspeaker for the second channel. Besides seriously encroaching on the floor area, the conventional size enclosures required for 12 inch loudspeakers also introduce placement problems which can prevent good stereo reproduction. It was to overcome these drawbacks that Rola developed the new 8 inch Model 8MX and designed a compact enclosure for use with it.

The frequency range of the 8MX is conservatively stated to extend from 60 cycles per second to 10 K.C., but when used in its special enclosure—its capacity is less than 2 cubic feet—the 8MX adequately reproduces the full tonal range from the organ's deep notes to the high frequencies of the cymbals, triangles and maracas.

Full details of the 8MX and constructional information on the Rola-designed vented enclosure for use with it are available, free and post free, from the Sales Department, Rola Company (Aust.) Pty. Ltd., The Boulevard, Richmond, E.1, Victoria.



ts superb control of tone, but in the omplete ease, certainty and authority vith which everything is done.

The pianist supports well, but he is so ar in the background as to be almost naudible at times, and there is a reververation on the piano which highlights he forward recording of the clarinet. It akes a little getting used to, but I would nuch sooner have it that way than to ind Kell's beautiful notes lost or broken y the over-intrusion of any other sound.

This is in the first rank of clarinet ecords and its very quiet surface is a urther encouragement to buy.

★ ★ ★

BEETHOVEN — Four Sonatas; Moonlight, Opus 27, No. 2; Appassionata, Opus 57; Les Adieux, Opus 81a; A Therese, Opus 78. Played by Robert Casadesus. Coronet, KLC670.

The big attraction here is that you et four popular Beethoven sonatas on single disc, and I do not know of nother which has so much to offer.

And as the performances are all good nd reliable, the attraction is quite apreciable, although if you were to pick ut the best there are of each sonata doubt whether you would end up with ny of them.

Life isn't as easy as that!

Casadesus is better known for Ravel nd Debussy than for Beethoven, alough he has made recordings other an this.

But he is an excellent pianist, and n all-round type, who can be relied pon to play almost anything well and character.

My comment on his approach is that e is preoccupied with his fingers, and annot avoid letting them take control the pleasure of displaying his clarity nd dexterity in the many definitive assages for the right hand.

The point is that these are there on any occasions, and are quite subdinate to the music We should not so aware of their presence as in these erformances; we should not have them obviously brought to our notice.

To play them so deliberately as does asadesus is to make his work at times und fiddly, and that is fatal to Beeoven.

It is not remarkable, therefore, that thought he was best in the Appasonata, where he hasn't the same oppornity

His dynamics, too, are sometimes treme. I don't mean that vigour is isplaced in this music, but exaggerated namics can be an affectation as much anything else, and are more approiate to other places and music for hich the pianist is more famous

A good deal of this is personal coment, for you may not object to hear Beethoven in this way. But to me ey are faults in style

On the credit side he has obviously ken his work very seriously, and parularly in the Appassionata makes a e showing.

Some of the quieter passages elseere are also beautifully played.

I did notice a pronounced variation room acoustics from one sonata to other, and even in the same moveent, as, for instance, in the last movent of the Moonlight, as though the crophone had been moved during the ording.

Piano tone is quite good, although there are some instances of groove echo and a cutting amplitude which just get by.

The surface is satisfactory, but not completely quiet.

All in all, a tempting buy.

★ ★ ★

TCHAIKOWSKY. — Overture 1812, Opus 45; Capriccio Italien, Opus 49. Played by the Concertgebouw Orchestra, conducted by Paul van Kempen. Philips S06078R.

There is some very solid amplitude on this disc which would have completely swamped any possible defects such as surface noise, assuming there had been any.

But, because there is only an insignificant amount, the wide dynamic range is heard to good effect.

To be highly critical, the power passages are a bit noisy, although in such music as the Capriccio it is rather hard to avoid this. But the front-rank versions have managed to balance themselves more successfully.

The cymbals crash realistically, and the bass is strong when needed.

The same general remarks apply to the 1812 Overture, which is probably one of the rowdiest pieces ever written.

The playing is quite good, but the interpretation, to use the classic phrase, has no surprises.

Some errors of balance have placed the strings in a forward position and the woodwind, for instance, apparently half-way down the hall.

That devilishly difficult climax to 1812 turned out to be a bit messy, mainly because of the enthusiasm of the man with the gongs.

The conductor wields a vigorous and often powerful baton, and the orchestra works like a band of Trojans, but I looked for more imagination and fire as being needed to class it with the best versions.

Nevertheless, it is an economical way to obtain two of the composer's most popular smaller works.

★ ★ ★

IMMORTAL OPERETTAS.— Songs from "White Horse Inn," "The Merry Widow," "Vagabond King," "Maid of the Mountains," "Lilac Time," and "The Student Prince." Sung by Vanessa Lee, with Westminster Concert Orchestra and Chorus. World Record S7.

This collection of popular musical comedy numbers is rather a lightweight for sound.

Orchestra and chorus are subdued and rather thin in quality.

This allows the singer to occupy plenty of microphone, which is probably a good thing as her voice is not a strong one.

It has a husky quality, which is quite pleasant, but which may not hold interest for more than one side at a time.

On the other hand, how many singers can?

As a recording, the voice is quite good, well forward and clean in sound.

The chorus is perhaps the weakest link, particularly when it emerges from a merciful background.

The 20 songs contain the pick of numbers from some of the world's most popular and best musical shows, and this gives it a great pull. Even less competently presented, it would undoubtedly sell well.

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SHORT-WAVE NOTES BY ART CUSHEN

KABUL HAS FAIR SIGNAL ON 4710Kc

Reception of the seldom-heard broadcasts from Afghanistan in the mornings has been possible on 4710 Kc.

THE reception of the Afghanistan signals on 4710 Kc. has ended a long search for this elusive signal which has been recently reported as using four frequencies within the past six months.

Our reception of the broadcast from Kabul was from 2.50 a.m. when the signal was received at good strength and a news broadcast in English was released. Shortly after 3 a.m. a musical session was broadcast and at 3.10 a.m. a male announcer thanked listeners for tuning to the program and asked them to tune to Radio Kabul the next evening.

The station when commencing transmission refers to its medium wave frequency of 660 Kc. and gives the local time as 9.20 p.m. or 1650 hours G.M.T. The signals at times suffer from some aircraft interference but nevertheless this isolated station can be tuned most mornings and its reception will add another country to the long list which has been heard by many of our readers.

Inchon on 3195Kc

A REPORT from Japan states that the missionary radio, HLKX in Inchon, South Korea, has been heard on 3195 Kc., signing off at 3.30 a.m.

On Saturdays the station is in English and broadcasts to 11.30 p.m., but on other days signals can be heard from 8 p.m. to 3.30 a.m.

The station is in Korean from 8 p.m., from 9.30 p.m. in Russian, and from 11.30 p.m. in Chinese, while from 1.30 a.m. the transmission is concluded with broadcasts in Russian.

The full schedule is on the air from 9 a.m., at which time Korean is used to 11.30 a.m., when programs in English are released to 8 p.m. From our observations here in New Zealand, we doubt if this is a fundamental short-wave station, as in the past few days the HLKX broadcast band transmitter has appeared on 1065 Kc. and this would mean that 3195 Kc. would be the third harmonic of this station.

New Transmissions from Tokyo

THE introduction of a new transmission for Central America and the alteration of the timing of the broadcast to Australia and New Zealand have been made by Radio Japan.

1.30 to 2.30 a.m., to India, Pakistan, on 15325, 11780 Kc.

3.30 to 4.30 a.m., to Near East, on 15325 and 11705 Kc.

10.30 to 11.30 a.m., to Eastern North America, on 21620 and 17855 Kc.

1 to 2 p.m., to Central America, on 17855 and 15325 Kc.

3 to 4 p.m., to Western North America, on 17855 and 15325 Kc.

4.30 to 6.30 p.m., to Europe and the Soviet Union, on 21620, 17855 Kc.

5 to 6 p.m., to the Hawaiian Islands, on 17825 and 15235 Kc.

7 to 8 p.m., to South America, on 11705 and 9525 Kc.

7.30 to 8.30 p.m., to Australia and New Zealand, on 15235 and 11940 Kc.

8.45 to 10.45 p.m., to North and Central China, on 11705 and 9525 Kc.

9.30 to 10.30 p.m., to Philippines and Indonesia, on 17855 and 15325 Kc.

11 p.m. to 1 a.m., to South China and Burma, on 15235 and 11705 Kc.

Five transmissions are now broadcast for East Asia and these are released from Tokyo, 11 to 11.30 a.m. in English and Japanese, 1 to 1.30 p.m. in Japanese, 4 to 4.30 p.m. in Japanese, and 8 to 8.30 p.m. in English and Japanese, on 15135 Kc. The service 10 to 12.30 a.m. on 11800 Kc. is broadcast in Japanese only. The DX session from Radio Japan will be heard on the fourth Saturday of each month at 10.35 a.m., 3.15 p.m., 6.05 p.m. and 7.55 p.m.

Broadcasts from Malgache

BROADCASTS from the new Malgache Republic which was formerly Madagascar, are now carried in both French and Malgache on two networks. The transmissions in French at present are heard from 1.30 to 3.30 p.m. and 7 to 9 p.m. and 3 to 5 a.m. On Saturday the schedule is from 7 p.m. to 5.30 a.m. Sunday. The station uses 5016 4Kw., 7280 Kc. 5Kw. and 9515 Kc. 4Kw. to 9 p.m. After this time the frequencies and powers used are 5016 Kc. with 4Kw., 7280 Kc. 5Kw. The Malgache network is on the air 1.30 to 3 p.m., 7 to 9 p.m. and 1 a.m. to 4 a.m. The station uses 7155 Kc. with 4Kw., and to 10 p.m. the additional frequency of 9693 Kc 4Kw. is also in service. From 1 a.m. the additional frequency of 3386 Kc. with 4Kw. carries the Malgache network.

Summer Time for Peru

THE recent reception of stations in Peru in the evenings at a much earlier hour has been explained in the news from the World Radio Handbook that Peru now has summer-time. The stations in this country are now heard in our summer one hour earlier. This first year of the use of this new time zone in Peru appears to have concluded, and it seems only to be in force from January 15 to March 15 each year. The reception of the Radio National transmissions from Lima has been noted on 9562 Kc. at 8.30 p.m. instead of 9.30 p.m. as formerly, and this explains the position. The stations have now reverted to standard time.

News from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Australian Eastern Time.

Extension of Oslo Broadcasts

AN extension of the schedule of Radio Norway in Oslo recently took effect and in it the use of the 11-metre frequency of 25900 Kc. has been further extended. This outlet, which uses the very low power of only 100 watts has frequently been heard when opening at 9 p.m. and the increased use of the frequency will enable the station to be heard more often.

Here is the schedule:

4.30 to 5.30 p.m. (Sunday, 5.30 to 6.55 p.m.), 11735, 15175, 17825, 21670, 25900 Kc.

7.25 to 7.35 p.m. weekdays, 6130, 15175, 17825, 21670, 25900 Kc.

9 to 10.15 p.m. (Sunday 9 to 10.25 p.m.), 6130, 11735, 15175, 17825, 21670, 25900 Kc.

11 p.m. to 12.15 a.m. (Sunday to 12.25 a.m.) on 6130, 15175, 17825, 21670, 25900 Kc.

2 to 3.10 a.m. (Sunday to 3.25 a.m.) and 3.10 a.m. to 7 a.m., using 6130, 9610, 15175, 17825, 21670, 25900 Kc.

8.55 to 9.30 a.m., 9 to 10.15 a.m., 6130, 11735, 15175, 17825, 21670 and 25900 Kc.

11 a.m. to 12.15 p.m., 2 p.m. to 3.15 p.m., on 6130, 9610, 11735, 15175 Kc.

The entire Home Service from Oslo is now carried on the Tromso transmitter, which uses 11850 Kc. The Oslo broadcasts open with an English transmission announcement, and on Sunday the extra time is devoted to answering the mail from listeners and playing request numbers.

AUSTRALIAN DX SESSION

The popular program from Radio Australia in Melbourne, broadcast each week for the DX listener, is now on its winter schedule. The program, which is compiled by Graham Hutchins, is now on the air at the following times:

Sunday, 8.00 a.m., on 15240 Kc. to East Asia.
Sunday, 3.30 p.m., on 21680 Kc to Africa.
Sunday, 5.15 p.m. on 11710 Kc. to Europe and New Zealand.
Sunday, 11.00 p.m., on 11810 Kc. to North America East Coast.
Monday, at 2.00 a.m., on 11810 Kc. to North America East Coast and to South East Asia on 11710, 9580, 7220 Kc.

FLASHES FROM EVERYWHERE

SWITZERLAND has anounced that the popul
DX session from Berne is now being broadcast
a weekly instead of a monthly basis. The sessi
which will be released in all eight transmissio
will be heard in this country in two transmissio
—to North America from 2.15 to 3 p.m., and
Australia from 5.15 to 7 p.m. The session
heard in the transmisisons on Friday and will
entitled "DX Corner."

INDONESIA is reported on the new frequen
of 9525 Kc., with relays from the Djakarta st
tion. The programs are the same as on 60
and 4803 Kc., and can be heard from 9.45 p.
to sign off at 1.30 a.m. Medan has been not
on 3415 Kc. instead of 3395 Kc. in its tran
misison of the local programs.

TAIPEH station of the Fuching Broadcasti
Station, "The Voice of Revival," has informed
Cyprus listener of a change of frequency fro
3375 to 9755 Kc. The station is heard here fro
11.30 to 12.30 a.m. with light interference fro
Moscow, using 9760 Kc.

ANDORRA is the home of a new radio static
which uses the slogan "Radio Andorrandia" a
transmits on 6306 Kc. The station uses this fr
quency from 9 to 11 p.m. and from 4 to 8 a.
The station has transmissions in both French a
Spanish.

CEYLON has altered the schedule of its com
mercial service to South-East Asia on 17820 K
This transmission is now carried only from 7.
to 8.45 p.m.

PEKING, with transmissions to the South Paci
from 7 to 7.57 p.m., is released on 15060 a
17835 Kc. A further transmission, which is
the air from 7 to 7.30 p.m., is released on 118
and 15095 Kc.

HAVANA, with its transmissions on COBL, h
returned to the air and is now operating
its usual frequency of 9833 Kc. The station
now being heard from 8 a.m. to 4 p.m.

SURIMAN transmissions on AVROS at Param
ribo now uses the frequency of 4852 Kc. fro
7.30 p.m. to 7.30 a.m., and from 7.30 a.m.
12.30 p.m. transmission is on 3395 and 154
Kc. The transmissions of 15405 have been
placed recently by 15227 Kc. The station carri
news in Dutch at 7.50 p.m. and 12.15 p.m. En
lish and Spanish for the West Indies is carri
only on Tuesdays at 11.30 a.m. to noon.

FAR EAST NETWORK, which broadcasts fro
Japan for the Forces in Japan and Korea, is
a 24-hour-a-day basis. The present broadcasti
schedule for the stations is 1.59 a.m. to 10.
a.m. on 6160 Kc. 10Kw., and 11750 Kc. al
10 Kw., 10.31 a.m. to 5.30 p.m. also on 11750 K
10 Kw., 10.45 a.m. to 6.30 p.m. on 6160 K
1 Kw., and 15257 Kc., 10 Kw.; 5.30 p.m.
4.05 a.m., 11750 Kc., 10 Kw.; 6.45 p.m. to 4.
am., on 6160 Kc. with 10 Kw.

KUWAIT begins its transmissions on 5000 Kc.
1.30 a.m. The station follows with a progr
summary at 1.35 a.m., has a program in Korea
The station has been heard to 6 a.m., but t
frequency employed is one which has considera
interference from WWV, the frequency measu
ment and time station also operating on 5000 K

COLOMBO, the home of commercial service
Radio Ceylon, advises some frequency changes
its transmissions which have the use of a 100,0
watt transmitter, which is often heard in t
country. The station in its English broadcast
Asia from 11.30 a.m. to 1.30 p.m. on 15265 K
including relay of the B.B.C. news at noon, 10.
p.m. to 2.30 a.m. the service to Asia is on 95
Kc. The Hindi program from 11.30 a.m. to 2
p.m. is on 15120, 9520 Kc. From 9 p.m.,
Sundays from 8.30 p.m., the transmission is
Hindi on 7190 and 11770 Kc., to sign off 3.30 a.

MADRAS, with regional broadcasts of All In
Radio, uses 21570 Kc., which replaces the 214
Kc. outlet. The broadcast from Madras is on
air 9.30 to 10.30 p.m. with broadcasts beam
to South-East Asia.

DACCA, which has broadcasts to West Pak
tan, now carries this broadcast 1.45 to 2 p.m., a
uses 21630 Kc. Dacca also uses 5970 Kc. a
this frequency is used from 11.30 p.m. to 2
a.m.

SINGAPORE, which is the home of the For
Broadcasting Unit, and a station very seldom
ported these days, is still using 5010 Kc. a
the power on this frequency is 7500 watts. T
station of G.H.Q., Far-East Land Forces, is
the air 10 p.m. to midnight daily, and the p
grams consist of Gurkhali programs and ne
drama and features, while Maruti and Hindi
also carried.

LUXEMBOURG now uses 15335 Kc., replac
15350, for the period 3.45 to 7 a.m. The ot
outlet of the station on 6090 Kc. has a r
program in German of a religious nature fr
3.30 to 4 a.m., and following this the Eng
broadcasts are heard.

AMATEUR BANDS WITH BILL MOORE

Radio amateur organisations throughout the world have in recent months been arranging for representation at the forthcoming I.T.U. Convention at Geneva. All bodies appreciate the serious nature of threats to amateur frequency allocations and are taking every action to ensure the strongest case is presented on behalf of the radio amateurs.

MAIN news these days in amateur radio circles concerns representation for the movement at his year's I.T.U. Geneva Conference.

It is the intention of Region I amateur radio organisations to send two observers from the Region I I.A.R.U. organisation. Their expenses will be financed from a special fund which has been established by I.A.R.U. National Societies.

Contributions to the fund, which was opened in April, 1957, are made on a pro-rata membership basis. The pooling of resources is in the best interests of amateur radio and, with the number of societies contributing, expense to any individual body is not excessively high.

Societies in Europe are awaiting the receipt of the final proposals to be presented and any that appear to be aimed at a reduction of our present rights will be challenged.

In Australia the tape played over W.I.A. stations providing the official statement on I.T.U. matters and carrying the speech of the Federal president, Max Hull, VK3ZS, was received with tremendous interest. Subsequently the subject matter was covered in an article in "Amateur Radio."

The Federal president, in a forthright and instructive discourse, presented the position very clearly and it is essential that every amateur in the Commonwealth should hear or read the statement if the W.I.A.'s I.T.U. fund is to be fully supported.

Amateurs would then have no doubt as to the value and advisability of effective representation at Geneva.

PRESIDENT'S REMARKS

The Federal president was introduced by the Federal secretary, Doug Bowie, VK3DU, and during the tape the W.I.A. delegate to Geneva, John Moyle, VK2JU, was introduced and his original speech broadcast over VK2WI immediately after his appointment was replayed.

Max covered all aspects of the Federal executive's preliminary actions and negotiations and the following is a summary of some of the points covered in the speech.

The Federal president covered the various decisions of the Atlantic City I.T.U. conference held in 1947, the tremendous increase in requirements for frequencies by all services after the war, and how the amateur service was recognised on an international basis.

He traced the history of the movement and pointed out that amateurs could not rest on this record with outstanding achievements, such as the pioneering of the short waves.

To justify their occupancy of frequency channels they must provide concrete evidence of service to the community.

The Federal president mentioned that commercial interests (a broad term covering all other radio services) were not interested in the radio amateur when frequency allocations were concerned. They might employ them when it was convenient and of value to their organisations but support at conferences on frequencies was not forthcoming.

It was of interest, too, that the amateurs of national societies represented at Atlantic City, i.e., R.S.G.B. and A.R.R.L., obtained better frequency considerations than those in Zone 3. It might have been coincidental but here in Australia we received smaller band widths than in many countries. In view of these circumstances, and other varied factors, the Federal president emphasised the extreme importance that Australia should be represented at Geneva.

THE I.T.U. FUND

At the time of the preparation of the speech £1.800 net had been received toward the I.T.U. fund target of £2.500. In view of the clear explanation of the position and requirements provided by the Federal president, further contributions should be forthcoming:

VK3ZS then covered the functioning of I.T.U. conferences and how the various nations forward their allocation proposals to Geneva.

These are then gathered in a "volume of proposals" and referred back to the various nations for final examination.

In Australia the Frequency Allocation Sub-Committee comprised representatives from such utilities and departments as the P.M.G., D.C.A., O.T.C., Aust. B./C. Control Board, Department of Supply and the armed services, Navy, Army and Air Force. This committee drew up the proposals that were sent to Geneva.

Members of the Federal executive did attend a meeting of F.A.S.C., at short notice, but the committee would not reopen discussions to hear the full context of the W.I.A.'s 16-page submission.

According to the Federal president, the original proposals submitted to Geneva included a reduction of the amateur 3.5 Mcs. band by 100 Kcs., the 7.0 Mcs. band by 50 Kcs. and the 14.0 Mcs. band by 50 Kcs. No changes were suggested for other amateur bands.

The foregoing covers only a few of the points made in Max Hull, VK3ZS, speech. Main emphasis was made on the point that the "volume of proposals" has to be returned and examined, and that the institute will endeavour to obtain some mitigation of the suggested frequency reductions.

The Federal executive is and has been working hard along these lines. Undoubtedly we have to fight and many persons in the right places will be supporting the cause.

The recording is an outstanding documentation of a phase in Australian amateur radio history and should be preserved.

Individual amateurs and other interested persons who have not supported the I.T.U. fund should seriously consider the position.

Donations should be forwarded to the Federal Executive, W.I.A., Box 2611W, G.P.O., Melbourne, Victoria, or via your local W.I.A. Division.

International Ham Club

FOLLOWING a trip of G3CED, some years ago, when he visited a number of amateurs in Germany, came the idea of the "International Ham Hop Club."

The object is to provide various kinds of hospitality, ranging from international links between amateur radio clubs, to exchange holidays between members and their families, an overnight stop or just a "ragchew" and a cup of tea in the shack.

The "Ham Hop Club" provides that little bit of organisation which is needed to smooth the way for such personal meetings.

The club, run entirely on a voluntary basis, is growing rapidly both in Europe and in the U.S.A.

In the past two years members of many nations, often accompanied by their wives, have enjoyed "Ham Hops." One enters the family circle of one's host and so obtains an intimate impression of the lives of many folks of all ranks and of all nations which is denied to those who travel along more conventional lines.

Through the goodwill of its varied international membership, the club is able to help members in many ways.

Members can be supplied with advice on travel, the best routes and details of fare concessions available. At Dover, visiting members are met and escorted through Customs and other formalities. Help with translations from all languages can be obtained and, with the increasing membership, still more assistance should be forthcoming in furthering hospitality and understanding between radio amateurs of all countries.

The movement is renowned for the welcome given overseas visitors and the club can be of great value to the amateur traveller.

Licensed amateurs are invited to write for full details to G. A. Partridge, G3CED, Hon. General Secretary, I.H.H.C., 17 Ethel Road, Broadstairs, Kent, England. An SAE should be enclosed.

Convention at Urunga

THE eleventh annual Urunga convention of the W.I.A., North Coast Zone, held as usual over Easter, was easily the best attended and most successful event held to date. Seventy persons registered, including Don McKenzie, VK3ALQ, and a host of VK4s, including old-timer George Heilbonn, VK4GG.

The weather was not very kind to the participants but this was not peculiar to this section of the State, as deluges in most areas of N.S.W occurred over the holiday period.

From the opening session, the information-cum-complaints gathering on the Friday evening, through the Saturday "Do-me" event to the Sunday evening concert, the visitors thoroughly enjoyed the entertainment provided.

On Saturday evening, Hugo Stitt, VK2WH, provided a tape on "Sputniks" which was very informative. A film of a major operation followed, which cured many amateurs from smoking for the rest of the convention.

Jack Gerrard, VK2ADN, provided 2,000 feet of 16m film in Technicolor of his American tour. It was beautifully taken and Jack provided an interesting commentary.

The talent available for the Sunday concert was excellent and was a portion of the program enjoyed by all.

The 7 Mc. hidden transmitter search, a new feature, was very popular, and Allan Williams, VK2FH, won the event after an extension of time. Jim Cummings, VK2PM, was a close second. 7 Mc. searches are certainly more difficult events than those conducted on the VHF. One never knows if the bearing will lead to the transmitter.

The 144 Mc. hidden transmitter search resulted in a win for the usual collector of these trophies in the area, Zone Officer Noel Hanson, VK2AHH. Again in second place was Jim Cummings, VK2PM.

Jim obtained his revenge in the 7 Mc. scramble event, when he took out first prize. Second, Noel Hanson, VK2AHH.

Councillor Dave Duff, VK2EO, and treasurer Bob Luther, VK2ZEL, officially represented the N.S.W. Division at the convention, and the former presented the VK2WI Sunday broadcast from Urunga.

Chief organisers for the convention were Rod Pike, VK2ACU, and Crieff Retallick, VK2XO. They had a host of assistants and all could be well pleased with the results of their work.

Annual Elections

MOST annual elections in branches and sections of the N.S.W. Division of the W.I.A. are held in March and the following officers were elected in these units for the year 1959-60.

Newcastle Branch: President, Lionel Swain, VK2CS; vice-president, Bob Rose, VK2AQR; secretary, Gordon Sutherland; treasurer, Bill Hall, VK2XT; social secretary, Gordon Sutherland; social treasurer, Bob Bailey; zone correspondent, Bob Rose, VK2AQR; branch liaison officer, Stuart Fairbairn, VK2ZDF.

The annual meeting of the branch was held at the University of N.S.W., Tighes Hill, and was well attended. Films provided by Mullard

THE FEDERAL CONVENTION AT EASTER

DURING Easter, delegates from all areas of the Commonwealth gathered in Melbourne for the Twenty-fifth Federal Convention of the W.I.A. It was perhaps the most momentous convention yet held. It was certainly the longest. Those attending were in session for a total of 38 hours.

Most important feature was the briefing of the W.I.A.'s observer/adviser for the I.T.U Geneva Convention, John Moyle, VK2JU.

Opening at midday, Friday, the delegates were in session for morning, afternoon and evening periods through until 5 p.m. on Monday.

Publicity details of the convention were carried over broadcast stations and the TV news in Melbourne.

Federal councillors assembling for the deliberations were as follows:—N.S.W., Bob Godsall, VK2ARG; Victoria, Dave Wardlaw, VK3ADW; Queensland, Jim Rafter, VK4PR; South Australia, Rex Richards, VK5DO; Western Australia, Ron Hugo, VK6KW; Tasmania, Ted Cruise, VK7EJ, and Papua, New Guinea, Proxy—Ron Chugg, VK3AYC, an ex-VK9.

Members of the Federal executive in attendance were the Federal president, Max Hull, VK3ZS; Federal secretary, Doug Bowie, VK3DU; George Glover, VK3AG; Bill Mitchell, VK3UM; Bob Boase, VK3NI, and John Moyle, VK2JU.

Observers from State divisions were Perce Healy, VK2APQ; Gordon Bowen, VK5XU; Les Duncan, VK5AX, and Fred Bail, VK3YS.

At the dinner held on the Saturday evening were Senator Hannan and Mr Frank Punch, of the P.M.G.'s Department, as guests, and John Moyle, VK2JU, as guest speaker.

The agenda paper covered a wide variety of subjects affecting W.I.A. administration and there were an additional 14 items of general business. Besides the normal convention subjects, nearly a whole day was spent briefing and discussing with the W.I.A. I.T.U. observer all aspects of the institute's case to be presented.

The full details of the deliberations will be promulgated later and the report will be awaited with interest.

P933.58

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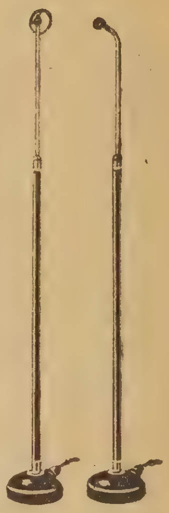
While taking stock this year a small number of the "near invisible" L.W. acoustical microphones were uncovered. This is the microphone now used by TV Studios. Specially designed for high fidelity and natural sound reproduction with the minimum of visual obstruction, it is a valuable item for keen hobbyist and entertainer alike. They are on stands with straight or bent tube and are available (*below cost* price for quick clearance) on application at any Philips branch office.



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ust. Ltd. were shown and John Moyle, VK2JU, emonstrated and lectured upon Stereophonic ound.

The Central Coast section also held their anual meeting in March. Results of the elections ere as follows: President, Major Collett, VK2RU; ice-presidents, John Fullagar, VK2AJY, and Doug earsall, VK2ASA; secretary-treasurer, Reg Brook, K2AI; education officer, Rex Black, VK2YA.

Lecturer at the meeting was John Lark, K2ZAV; his subject, VHF Equipment. A numer of visitors were in attendance from the Newastle Branch.

The third election held during the month was t the Blue Mountains section meeting and officers ppointed were: President, Wal Cromie, VK2MZ; ecretary, Bill Moore, VK2HZ; treasurer, Norm urham, VK2QA; publicity officer, Bob Lear, K2ASZ, and catering officer, Syd Williams K2AVK. The latter appointment was to ensure e attendance of members during the forthcoming inter months.

Norm Beard, VK2ALJ, resigned from the posiion of secretary of the N.S.W. Division, W.I.A., n March. Amateurs in the State appreciate that orm performed a tremendous amount of work uring his stay in office and thank him for the ervices rendered. Of all positions in W.I.A. adinistration, the secretary's job is the most arduus and in that capacity he takes more than his hare of responsibility. Filling the position for he moment is Morrie Marsden, VK2VV, assistantecretary.

DX on 50 Mc

EASTER provided some good DX for the 50 Mc. band and again the JAs managed to be eard as far south as Sydney. As usual, during he period. Ian, VK2AXI, Jack Hill, VK2ADT, nd others in northern N.S.W. heard the JAs aily around this time. Some of the signals eached S9 at times. Japanese TV stations around 9/50 Mcs. were also well received. Ian, VK2AXI, eard all JA prefixes over the holidays. Generlly, however, signals at any one stage came from ne particular small area.

April MUF predictions indicate that the month hould provide interesting DX contacts. May hows some falling off in possible openings but he band should remain in fair shape neverthess.

Predicted MUF around the equator in April as as high as 54 Mcs. with reductions to 45 cs. around Sydney.

Overseas business in I.A.R.U. W.A.C. awards or 50 Mc. working has been on the increase. 5 such certificates being issued to date.

All the recipients are U.S. amateurs and cover 6. W8. W9 and W zero call areas.

The number of W.A.S. certificates issued has lso greatly increased for 50 Mc. working; 62 wards have been made to date and cover all W all areas except W4. Hand-lettered certificates ere issued by the A.R.R.L. to the first station n each of the call areas to qualify.

The JAs, too, have been working consistently cross the Pacific. JA4LG, with only 2 watts' nput to a 6AQ5, has been consistently contacted

This gives some indication of the excellent penings occurring. W7RT contacting over 140 ifferent JAs in 32 days. East Coast Ws have or the first time worked into Italy on 50 Mcs., hile the ZSs have been QSO with European staions on the band.

VQ5GF has worked with W1, W2, W3 and W8, and East African stations will continue to se the band despite the closing of the I.G.Y. This is a special grant from the authorities.

The general impression in Europe is that the onditions existing during December, January, February on 50 Mcs., were not as good as during the corresponding period last year. Fewer signals were heard from the U.S. and the periods during which the band opened were much shorter.

Conditions were still good for 50 Mcs. stations around Sydney during the first week in April. VK2RX and VK2ZAV worked JAs as did VK2JX. The latter also heard a B.B.C. news broadcast on 50 Mcs. at 2100 hours EAST but was unable to identify the station transmitting.

Moon Bounce

QUITE a deal of moon bouncing of signals has been carried out in recent months. Teletype signals in the UHF region of 1,000 Mcs. were successfully transmitted from Arizona and received in New Mexico, via the moon.

Earlier this year, PE1PL, the Dutch Government experimental station, received signals on 151 Mcs. from a station in New Jersey, U.S.A., via the moon. The transmitter had an output power of 50 Kw. CW.

VHF Group Officers

A FURTHER election held during the month was that of the VHF and TV group of the .S.W. Division.

The new president is John Lark, VK2ZAV, vice-president, Phil Card, VK2ZBX; secretary, Kev ollins, VK2ZFC; committee, Jim Webster, K2ZCW; Keith Jeffcoat, VK2ZJK; and Bob ear, VK2ASZ. Lecturer at the meeting was ast-president Bob Winch, VK2OA, and his subect, noise figures in receivers.

In a summary it was pointed out that the gain f the antenna and the loss in the feed line played more important role than inherent noise in the eceiver in receiving signals

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RADIO — TV

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HIGH POWERED STEREO

(Continued from Page 35)

A precise measure of maxinium ou put is subject to some variation accor ing to the state of the mains voltag individual tube characteristics, met accuracy, and output transformer effic ency, etc. The best figures we obtain from the EL37's at clipping point sho ed 19 watts output.

A pair of EL34's plugged into o channel under the same conditions ga almost exactly the same output at slightly lower current drain. Normal these valves run at much higher vol ages. but it is doubtful whether the would be any advantage in suggestir alterations to operating conditions wi a view to obtaining any variations test figures.

Substitution with 6L6's and KT66 was followed by a reduction in outp to approximately 12 watts, which is th figure anticipated earlier in this articl Current drains in all cases were ver similar.

As a matter of interest, KT88's we also tried out and they also gave th higher figure of output, although on would not normally prefer these valve with such a comparatively low voltag The square wave photograph include here is typical of this amplifier on an kind of load apart from one which i cludes a critical capacitance, and wa obtained by all the valves mentione above.

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GLASS SURROUNDS US WHILE WE LIVE

(Continued from Page 17)

cooling follows and the blanks are again inspected in the immersion tank.

The blanks are sealed in steel conground and polished into lenses. It is this process which makes good lenses so expensive.

The extensive use of television has brought new techniques into the glass industry, particularly in the manufacture of picture tubes.

The faces of the picture tube must be very accurate on both sides as an inequality would distort the image formed by the electron beam falling on to the phosphor surface.

The face of these tubes is very thick but at the sides where it tapers down to the neck it is thin. A problem arose in attaching the thin back to the thick face in such a manner that an airtight seal would be affected.

STRONG JOINT NEEDED

The joint must be as strong as the rest of the tube because the tube is exhausted of air to a very high degree. They are therefore subjected to great air pressures from the outside.

To obtain this perfect joint a high frequency electric arc was devised for this special purpose. Thus electronics came to the rescue of the glass industry in order to produce an electronic device.

How is the curve put in modern motor car windshields? It is very simple when you know how. This glass is of the safety type. It is put through a special heat process which places peculiar strains on the glass in such a way that when shattered it breaks into millions of small smooth edged pieces instead of jagged spikes.

The glass is cut to the required flat shape and placed over a mould of the required finished shape. It is then heated to a point where it is soft enough to sink of its own weight.

A startling new use for glass has been forecast by an American, Col. Bernt Balchen. He forecasts that by the year 2000 we will be flying in airliners 20 miles above the earth in huge airliners made of glass.

HIGH TEMPERATURES

His theory is that metal alloys now used in planes will not be able to withstand the heat of friction developed by the planes of the year 2000 flying at speeds of up to 8,000 miles per hour.

While the plane is climbing at say 1,000 miles per hour temperatures of up to 200 degrees will be encountered until the plane reaches a high altitude where the temperature will drop sharply because of reduced air friction.

Aluminium alloys will not stand the constant changes in temperature and therefore new substances will have to be devised to replace them.

Col. Balchen forecasts that the exteriors of the plane will be made of glass with a glass fuselage, wings, ailerons and stabilisers. Even the rivets will be of glass.

The kind of glass visualised is a phenolic resin impregnated glass fabric. This substance shows no loss of strength at the temperatures generated. With this material the planes can be moulded and thus would be considerably cheaper to build. It is pointed out that it is possible to laminate woven glass fabrics with certain silicones which are also heat resistant. Thus the overall heat resistant properties of the entire structure would be considerably increased.

There are over 50,000 formulas for the manufacture of glass. Each one makes some use of one or more of the 99 elements so that glass can be made to any specification to suit any purpose.

There are glasses which will resist the action of almost any acid or alkali. Glass can be made to conduct electricity or act as an insulator, to allow the passage of light of any specified wave length. It can be made lighter than balsa wood or cork or it can be as heavy as steel and as tough. In fact, there is no limit to the types which can be made or the uses to which it can be put. Glass is indeed a wonderful product and despite forecasts to the contrary, there seems no possibility that plastics will replace it in the forseeable future.

The beauty of stained glass windows, painted and cut bowls and vases (and bottles) can never be duplicated in any other material.

Melbourne Scientist Plots Cosmic Rays

(Continued from Page

ments are needed to link up with those obtained in Australia.

Dr Hopper believes that a broader picture, giving a means of following the changes that occur in the upper wind pattern, may lead to a better understanding of the basic mechanism which initiates upper wind disturbances.

The valve method applied to balloons can also be of value for studies at all levels and so will probably have large application to other meteorological problems.

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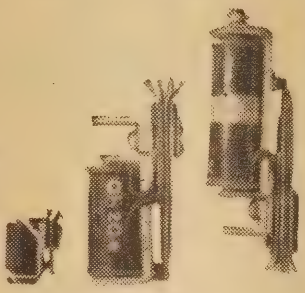

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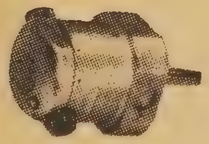

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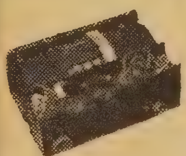

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4 for . 20/- 6U7G, 6J7G, 6SS7, 7C5, 2X2/879, 84, 1T4, 41, EBC33/6B6G, 6U5G.

3 for . 20/- EK32/VR57, EL32, 6K8G, 6K7GT, 3S4, 1S5, 6AG5, 1A7GT.

Post & Packing 4/6 extra

ALL VALVES ARE NEW AND MOSTLY IN INDIVIDUAL CARTONS

NEW VALVE SOCKETS

Ceramic EF50 sockets 2/6 ea. American moulded loctal 1/- ea. Octal 8 pin wafer 6/6 doz. Aphanol 5 pin ceramic 2/6 ea. Aphonal small 7 pin ceramic 2/6 ea. All post extra.

CONDENSER SPECIALS

Boxes of 100 new ceramic, mica, paper and electrolytic condensers in values ranging from 50pf mica to 5 400v paper. Values include .0001, .00025, .00075, .01, .02, .05, .1. Also 500 mfd/12v., 10 mfd/40v., 16 mfd/350v., electrolytics.

25/- per 100.

Post Extra: N.S.W. 2/6; Int., 3/6.

CONDENSER SPECIALS

100 new mica, paper and ceramic condensers, mixed values.

15/-

Post 2/-.

NEW I.R.C. RESISTORS

I.R.C. carbon resistors, ½, 1 and 2 watt, in values, 50 ohms. to 5 meg., including many popular sizes, 3T, 15T, 20T, 25T, 50T, 100T, 250T, 500 T, etc.

(Standard resistor colour code supplied.)

100 for 25/-

Plus 1/6 postage

New Micro-Ammeters

0-100 micro-amp 3in flush mounting

55/-

NEW METER RECTIFIERS. Westinghouse 1 mA rectifiers, 15/-.

GERMANIUM DIODES

for that Crystal Set

6/6, Post Free.

NEW 4in. Per-Mag. Speakers

5T. or 7T. Trans.

25/-

Post. and Packing, 3/6

SPECIAL!

NEW HIGH-FIDELITY 4-SPEED RECORD CHANGERS. TURNOVER CRYSTAL PICK-UP SAPPHIRE NEEDLES

£10/15/- F.O.R.

STANDARD INTERMEDIATE FREQUENCY TRANSFORMERS

455KC 1¼in square can. Slug tuned.

4/9 post extra

New Power Transformers

40mA prim.: 240v with 230v tapping. Sec 285 x 285 with 6.3v filament winding 60mA.

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Plus Postage, N.S.W., 3/6; INT., 5/3.

New Midget Power Trans.

40mA Prim.: 250v Sec. 225 x 225 with 6.3v. Fil. Winding Upright or Flat Mounting. Size 2in x 2½in

25/-

2/6 Postage, N.S.W.; interstate, 4/6.

30mA 240v Prim.; 150 x 150v Sec with 6.3v Fil Winding.

22/6 Postage, N.S.W., 2/6; Interstate, 3/6.

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Standard Mica Condensers, small current types. .00003 to 005, including most wanted values

10/- per 100. Postage 1/6.

CARBON RESISTORS

New carbon resistors, mixed values. Well-known make. 10/- per 100. Post free.

NEW POTENTIOMETERS

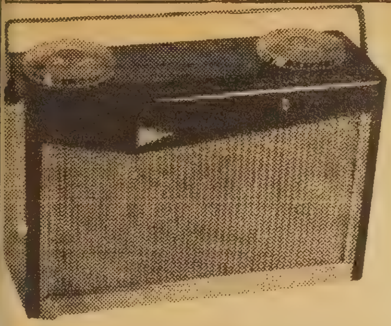
WITH SWITCH STANDARD SPINDLE.	WITH SWITCH SHORT SPINDLE.	LESS SWITCH STANDARD SPINDLE.	LESS SWITCH. SHORT SPINDLE.
25,000 ohms. 100,000 ohms., 500,000 ohms, 1. meg. ohm,	100,000 ohms. 500,000 ohms. 1 meg. ohm;	50,000 ohms. 100,000 ohms, 500,000 ohms, 1 meg.	50,000 ohms. 100,000 ohms, 500,000 ohms, 1 meg. ohm
4/6 ea. 42/- doz.	2/6 ea. 24/- doz.	3/6 ea., 33/- doz.	1/9 ea. 16/- doz.

500,000 ohm pots. can be supplied tapped at 40,000 if required, post extra.

Please address all correspondence to 332 Parramatta Road, Stanmore, N.S.W.

METROPOLITAN RADIO SUPPLIES

332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE LM7398
640 KING STREET, ST. PETERS, N.S.W. PHONE LA6087



MAKING R. & H. TRANSISTOR PORTABLE ?

COMPLETE KIT OF PARTS

£26/10/- Post extra.

SET WIRED AND TESTED £2 EXTRA

INCLUDING 6 S.T.C. TRANSISTORS, R.C.S. COILKIT WITH PRINTED CIRCUITS, ROLA TRANSFORMERS AND 5F SPEAKER & ALL PARTS NECESSARY TO COMPLETE THIS SET INCLUDING ATTRACTIVE & DURABLE TWO-TONE CABINET WITH GOLD TRIM.

7 TRANSISTOR PORTABLE

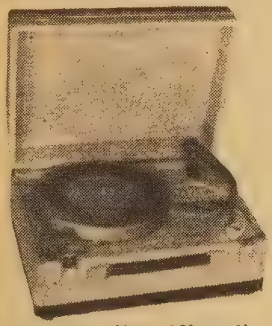
Specifications as above but with extra I.F. stage, giving better range and selectivity, also has extra coil for connecting to car aerial, making it ideal as a car set or for country locations.

Wired and tested. £3 extra. Post Extra. **£29**

3 TRANSISTOR – SET

(As described in March "Radio and Hobbies")

Complete kit of parts less cabinet. Attractive two-tone covered cabinet 40/ extra. **£10/10/-**



Cabinet size 13in x 10in x 6in.
Weight 11lb.

PORTABLE TRANSISTOR RADIOGRAM

Complete Transistor Six kit with B.S.R. four speed motor and crystal pick-up and attractive two-tone covered cabinet **£35**

As above but with Seven Transistor kit **£37/10/-**

Above sets wired and tested 6 Trans. 55/-. 7 Trans. 75/- extra.

PORTABLE TRANSISTORGRAM

Complete kit including B.S.R. Motor and Pick-up (4-speed) and attractive two-tone covered cabinet. **£25**

Wired and Tested, £2 extra. Postage extra.

NEW VALVES AT BARGAIN PRICES

ECH 35/VR99A.
Direct replacement for

6J8G	10/
1C4	7/6
1L4	4/6
1T4	7/6
1S5	10/
3S4	10/
3V4	12/6
1R5	12/6
1A7GT	9/6
1D8GT	9/6
6A8G	10/6
6K8G	9/6
6SJ7GT	9/6
6X5GT	10/
12K8	10/
6AC7	2/6
EK32	10/6
6SA7GT	9/6
6SH7	5/6
1Q5G	5/
1P5G	5/
1C7G	5/
1K5G	2/6
1L5	9/6
6A77	2/6
6C8G	7/6
6SS7	8/6
6H6	2/6
6H6GT	1/6
6K7GT	7/9
6U7G	6/6
6J7G	5/
6F8G	10/6
7C7	3/6
78	7/6
EL32	10/6
6V6GT	12/6
VR65A	2/6
41	7/6
7193	3/6
954	2/6
12A6	10/
EF50	2/6
811	£1
12SH7	5/
6K7G	4/6
1C6	7/6
955	2/6

Please add Postage on All Valves.
SPECIAL PRICES FOR QUANTITIES.

("Mercury" American Made.) These relay counters register from 0 to 99,999 can be supplied with 250-ohm coil 24v D.C. operation

25/-

Plus Postage.

TV IF STRIPS

Complete, wired and aligned, supplied with seven miniature valves. (Post extra) **£14/10/-**

TURRET-TUNERS £12/10/-

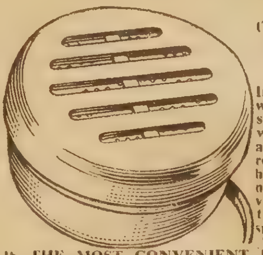
SPECIAL!

NEW ENGLISH TAPE DECKS

These new English high fidelity tape decks are 3 speed, 2 track, push button control, pause control, two motors. Frequency response to 12,000 cycles £32 F.O.R.

Oscillator coils for above 15/-.

PILLO-FONE EXTENSION UNIT



IT'S A REAL MINIATURE WITH ROLA UNIT

Install it anywhere, in the sick room, workshop, garage or any room in the house. Just connect across voice coil of the existing speaker. The 'PILLO-FONE' IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED.. 3½in Diameter by 1¾in deep.

POST FREE **22/6**

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640 KING STREET, ST. PETERS, N.S.W. PHONE LA6087

TELESCOPES

30 x 40 coated lens with tripod. Suit rifle clubs, etc. Length 28 inches, weight 1½lb.

£7/19/6

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TRIPODS

EX-ARMY.
BRASS TELESCOPIC DIRECTOR OR INSTRUMENT STAND.

£6/10/-

Each.
Freight payable at nearest attended Railway Station.

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1 3/8in diam., ¼in shaft, 30/ doz.
1¾in diam., ¼in shaft, 42/ doz.
2 3/8in diam., 3/8in shaft, 54/ doz.
3½in diam., 3/8in shaft, 66/ doz.
Add postage.

COPPER WIRE

BRAIDED.
Ideal Aerials, etc.

6/11 per 100 ft.

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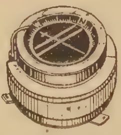
New. Suit cars, trucks, boats, staionary motors, etc.
0-150lb per sq. in.

£1 each

Complete with tubing.
Post N.S.W., 2/1; Int., 3/3.



P8 COMPASS

Liquid filled. As new.
Ex-R.A.A.F. Ideal for small boats, etc.

£3/15/- each

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PRISMATIC COMPASS

Ex-Army, LUMINOUS.
Guaranteed Correct.

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TV ANTENNA KIT

SIMPLE, DO IT YOURSELF.
Complete with tubing and suggested diagrams. Instructions supplied.

£3/9/6

Shop sales only.

VOLTMETER

Pocket Size.
0 to 15 volt D.C. and 0 to 220 volt D.C., with probes. In waterproof Canvas Case.

33/6 each

Post 3/4; Int., 4/6.

DIRECTOR DUMPY LEVEL

WITH TRIPOD.

£22/10/-

Freight payable at nearest attended railway station.

MAGNETO

12 cylinder platinum points adaptable to 4, 6 or 12 cylinder marine. [illegible] engines.

£4/10/-

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TELESCOPES EX-Army

Ottway of London.
With variable power adjustments. Length 26in. Weight 12lb.

£12/10/-

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LENSES

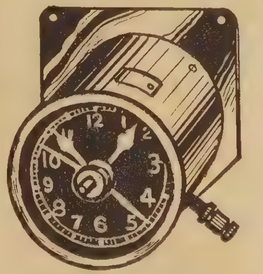
PLANO-CONVEX.
2 3/8in diam. New 10/ each.
Add postage.
Also assortment prisms, lenses, eyepieces, gears, etc.

GUNSIGHT COLLIMATOR

Contains Acromatic Lens, 1 7/8in diam., 4½in F.L., front silvered diagonal eliptical mirror, two worm traversing gears, sundry tubes, connector mirrors, etc.

27/6 ea.

Post, N.S.W. 3/11; Int. 6/3.



AIRCRAFT CLOCKS

SMITHS 8-DAY

£3/9/6

Ex-Rolls-Royce Merlin Aircraft.
With start of trip indicator. £1 extra
Post 3/1; Int. 4/3

VALVES NEW

1R5	12/6	EB34 ..	7/6
1T4	10/	HA1 .	15/
1S5	10/	EF8	7/6
3A4	12/6	837	9/6
GL8020	15/	83	9/6
EL5	7/6		
HA ..	15/	Cathode Ray	
H30	7/6	4/1	29/6

Add postage.

METERS

In Polished Wooden Case and Leather Carrying Case. Siemens, ex-Army.
Original Cost £28.
Dimension 7in x 7in x 4in
0 to 1 Milliamps, D.C.

£5/5/-

0 to 50 Amperes, A.C.

£7/5/-

Post, N.S.W., 6/2; Int., 9/6

HEADPHONES

High Impedance. Suit Crystal Sets. Lightweight. American.

22/6 pair

Post. N.S.W., 2/1; Int., 3/3.

AIR SPEED INDICATORS

NEW.

8/6

Post., N.S.W., 2/1; Int., 3/3.

WALKIE TALKIE BATTERIES

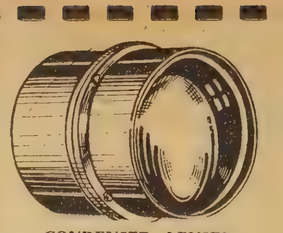
Suit CSR 536.
One H.T. 103½ one L.T. 1½V.

15/- pr.

Post N.S.W., 3/2; Int., 4/7.

MANIFOLD PRESSURE or VACUUM GAUGE

£1 each
NEW.
Post., N.S.W., 2/1; Int., 3/3.

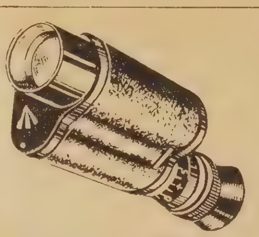


CONDENSER LENSES.

3½in WITH CELL,

£3/15/-

Reflector Mirror, Lens Lampholder, 35/ extra.
Post 4/2; Int., 5/7.



CARL ZEISS PRISMATIC MONOCULAR

9 x 25. Ideal race, marine or general use, with case .. ..

£5/15/-

English or American 8 x 30 Prismatic Monocular, with case, ...

£3/17/6

Post., 3/6; Int., 4/3

TRANSCEIVERS

2-Way Radio
No. 22 without power supply, £4/10/.
No. 19, 15 valves, etc., £4/19/6.
No. 128, 2 to 4.5 megs., Ideal ship to shore, fire-fighting, etc. £12.

WHIP AERIALS

Ideal for car or TV antennas or blackfish rods. 13ft in 12in sections.

19/6

Post 1/9, Int., 2/9.

GENEMOTORS

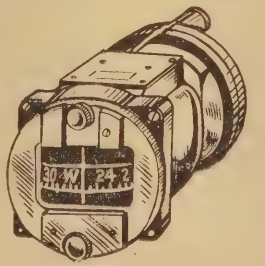
D.C. Input. 28v. D.C. Output. 250v.

30/- each

Post, N.S.W., 3/11; Int., 4/7.

MAKE YOUR OWN DUMPY LEVEL

with Astro Compass, 25/6.
Ottway Telescope Sight, 47/6.
Post., 5/2; Int., 7/6.



Dashboard COMPASS

Small ships. Pioneer American. Liquid Damped with Light.
Also suit as car compass.

£7/15/-

COMMAND RACKS

Receiver 3 tier 19/6 ea.
Transmitter 2 tier, 15/ ea.
Post., N.S.W., 2/3; Int., 4/3.

AIR TEMPERATURE GAUGE THERMOMETER

0-30 minus C 0.50 Plus C.

£1

Complete with tubing.
Post., N.S.W., 2/1; Int., 3/3.

BOOSTER COILS

For racing enthusiasts.
12v Bendix new type 512 Platinum Points.

22/6 ea.

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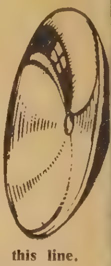
SEARCHLIGHT REFLECTOR MIRROR, 3ft PARABOLIC. Ideal Solar Heat experimenters. Hot water systems, etc. Also makes splendid Wall Mirror, especially when Fish Bowl or Flowers are placed in front. Has pleasant reflection effect.
Original cost, £80
SPECIAL PRICE

£5/15/-



Sorry, no Mail this line.

Mechanical REV. COUNTERS

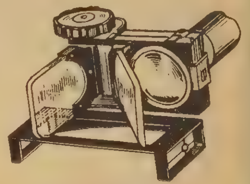
BENDIX.
New, 0 to 3000 r.p.m.

£4/19/6 each

or complete with flexible drive.

£6/15/-

Post., N.S.W., 3/; Int., 4/6.



GUNSIGHTS

Contain these lenses:
1 Lens 1" Focus ½" diam.
1 Lens 1 11-16 Focus, 1¼" diam.
1 Air spaced lens 1¼" diam.
1 Filter Lens, 1 Reticule.
1 Lampholder.

18/6 each

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FIELD STRENGTH METER

OUTFIT.
BRAND NEW.
COMPLETE.
100 to 155 m/Cs.
With 0-1 internal/external shunt meter, tools, battery box, signal generator and instruction book in dovetailed wooden case.

£17/10/-

Freight payable at nearest attended railway station

WALKIE TALKIE 2-WAY RADIO

Complete except for tank, coil, and crystal.

£4/19/6

Post: N.S.W., 4/2; Int., 5/7

ANGLE TELESCOPE

Can be used as Astronomical Finder or Prismatic Finder or Prismatic erecting eyepiece for high-powered Telescopes.

£3/5/-

Post 3/6

TELEPHONE CABLE

BRAND NEW, NYLEX ROTPROOF COVERED.

£4/17/6 per mile

Freight payable at nearest attended railway station

DEITCH BROS.

70 OXFORD STREET, SYDNEY
Between Crown and Riley Streets, City.

ANSWERS TO CORRESPONDENTS

O.S. (Auburn, N.S.W.) writes to tell us how he enjoys our magazine, and particularly Walters' recent articles. He also sends us ographs of a switched tuned version of the le General" which he has built. Finally he whether we have any details of electronic ing sticks for the blind which have been ioned in the Press.

Many thanks for your letter and comments, S., and we are glad to learn that you find magazine so interesting. Many thanks also the pictures of the switched tuned receiver. ortunately, there does not appear to be as h interest in this type of circuit as one might gine, but we will keep this idea in mind. have very little useful information concerning walking stick for the blind, and we would nable to provide any construction data. We publish a general interest article a few years but this was a reprint from an overseas ce. (December, 1955.)

B. (Lindfield, N.S.W.) raises a point concern- the V.T.V.M. in the January issue. He ts out that there is a possibility of flashover veen contacts 1 and 12 on the switch bank when voltages approaching 1,000 volts are g measured. He also suggests a simple modi- ion which he considers would avoid this risk.

Many thanks for the comment and sugges- J.B., and we agree that this does look to a risk, although we have not had time to nine the position closely. Your modification appears to be a logical one, and we will it a practical test just as soon as we can nine it in more detail. In the meantime, we only say that no trouble has occurred in tice, at least not so far.

J.D. (Coolgardie, W.A.) requests data on the osals CR tubes VCR139A and VCR138.

Details of the VCR138 are as follows: 3in neter, indirectly heated cathode 4 volt, 1 amp. ode 2 volts, 200. Grid 3 volts, 50. Anode 3 s 1200. Green screen.

he base is a CK12 and the connections as ows: 1, grid. 2, cathode. 3, 4, heater. 5, A1. A2. 8, Y2. 9, X2. 10, A3. 11, X1. 12, Y1 We e no details of the length of this tube.

etails of the VCR139A are as follows: 2.5in neter. Indirectly heated cathode, 4 volts 1.1 . Anode 1 800 volts. Anode 2 120 volts. d 1-12 volts. Anode 3,800 volts. Base, PS12 the connections as follows. 1, cathode, 2. 3, 4, heater. 5, anode 2. 7, y2. 8. X2 9 ode 1 and anode 3. 10, X1. 11, Y1

Ve have not had an opportunity to try these es as picture tubes, but they would appear be worth trying. We would refer you to the tember, 1958, issue for a discussion on this ject in general.

H.P. (Matraville, N.S.W.) writes to suggest we publish an article detailing what adjust- nts should and should not be touched by the ner, assuming some knowledge of radio cir- try. He also suggests an article on TV in- ance and service contracts.

We appreciate your problem, L.H.P., but, ortunately, it is not always possible to know how much knowledge each individual has uired. In general, the IF and other align- nt adjustments should be strictly avoided, since is virtually impossible to adjust them without truments. The semi-permanent adjustments. ght, width, linearity, etc., are not so critical may be adjusted if one exercises reasonable e. The main point to realise is that many of se interlock, making it necessary to juggle one inst the other for the desired result. It is possible for us to nominate the controls from sketch you supply, since we do not even know make of set. However, by careful marking present position of each, then adjusting htly, it usually will be possible to determine purpose or effect of each. On the other d, there is little point in adjusting these while r the set is performing correctly. We have mind to cover the subject of insurance schemes we can collect enough information on the ject.

N.R. (Killarney, W.A.) makes a suggestion as how a stereo system may be provided on a gle AM transmitter.

A. Many thanks for your letter, N.R., and the gestion you offer is an interesting one. From at we have been able to learn of overseas ex- iments, the idea of using sum and difference quencies has been known for some time, and feel sure that something along these general es already has been considered. However, we y be able to publish your letter in detail for interest and possible comment of other ders.

A.G.J. (Echuca, Vic.) has a question to ask arding the "Set for Young Dx-ers." It appears t A.G.J. is bothered by what he calls motor- ating. The set differs from the version des- bed in that 6AU6 valves had been used in ce of 6SH7's. The sound is irregular and varies pitch and intensity.

A. It is almost impossible to form a diagnosis the very limited information you supplied wever, it is certain that some form of in- bility is taking place. The usual precaution of bypassing the high tension line on both sides of the .01 meg decoupling resistor may prove to be a cure. Excessive regeneration may be the cause of trouble and we suggest that you check this point. If need be, the coil may be pruned a little to eliminate the trouble. Removing turns from the reaction winding or moving it away from the grid winding may help matters

L.S. (North Balywn, Vic.) asks about preamplifiers using transistors for extending crystal microphones over long distances.

A. This is a topical suggestion, L.S., and one which we may be able to act on at some time in the future. It may even be possible to use a single pair lead for connection, the one lead carrying both the audio supply to the amplifier and the DC power from the amplifier to the preamplifier. We regret, however, that we have no practical information at the moment. The immediate problem is the adverse loading by the transistor on the microphone and the consequent effect on bass response.

D.L. (Kew, Vic.) forwards a query for the Here's Your Answer, Tom, feature concerning lightning discharges.

A. there appears to be some complex physics involved in this matter, D.L., and we do not claim to be able to supply any detailed information on the subject. However, we will endeavour to provide a satisfactory explanation for the phenomena you mention.

J.J. (Albion, Qld.) is interested in converting his electronic flash outfit into a transistor type.

A. We have handled several commercial electronic flash units using transistors and the idea of developing one for description in the magazine has often occurred to us. However, there are so many other projects taking priority at the moment that we cannot make a definite promise as to when it will appear.

D.H. (East Brighton, Vic.): The multimeter can be used to measure power output from the amplifier. You will first need a steady tone to feed into the amplifier from an oscillator of some kind, preferably one which produces good waveform over the audible range. A simple oscillator to give a steady tone at say 1 kc would be useful if a more elaborate type isn't available The speaker is replaced by a non-inductive resistor of about 10 watts capacity and having a resistance equal to that of the speaker voice coil In practice a large, wire-wound resistor of the type often found on disposals counters would do. The meter is connected across this resistor so that it measures the AC volts developed across it when the amplifier is connected to the oscillator

The oscillator output is increased until overload point is reached, and the amplifier output at that point calculated by applying Ohm's Law. The square of the voltage is divided by the resistance. The best way to detect the overload point is to observe the output waveform on an oscillograph which will detect distortion of the pattern when overload is reached. As you see, there is a fair bit of instrumentation needed, but no easy way out of using it.

If you use a good output transformer with the amplifier its quality should be quite good, and up to hi-fi standards.

N.S. (Ocean Beach, N.S.W.) has an old set which fades occasionally, but returns to normal when he flicks the light switch or overloads with the volume control.

A. The cause could be either in the receiver or in the house wiring. In old receivers, coupling capacitors tend to develop leakages and resistors change in value, and either of these could upset the valve operating points which working the switch or volume control could temporarily restore. There could be some faults in almost any of the valves due to their age which could give the same effect. Sometimes badly earthed conduits in the electrical system will upset the earth circuit for the set through the mains earthing pin, and also cause this kind of fading, which is often very hard indeed to track down. With so many possibilities it really needs an experienced service man who is willing to take the trouble to find it.

However, check all valves to see they have no obvious faults, heater to cathode leakages, etc., and all the capacitors and resistors for leakage and correct values. Perhaps the most obvious course would be to provide a good and separate earth lead for the receiver in case the mains circuit is involved. In this you can get a lead by noting whether the fading occurs when the set is operated at some other address than your own.

R.S. (St. Kilda) says he has had a lot of pleasure building up a small transistor receiver and wants to enlarge it.

A By this time you will have seen the circuit in the March issue, which should meet your requirements. We have not had the opportunity yet of doing any work with a half-inch rod, but we will certainly publish any results when available.

"P.K." (Klemzig, S.A.) wants to know whether there is any difference between the specification 10,000 PP and 10,000 CT as applied to an output transformer.

A. In the first instance, the letters PP stand for Push-Pull, which of course refers to the type of connection used in the output stage, and as there are two output valves concerned, a centre-tapped output transformer will be necessary and is implied by the use of the letters PP. The letters CT, as you will probably have now realised, stand for Centre Tap, and the normal use for a centre-tapped transformer is in a push-pull circuit. So actually either method of describing the transformer means that it is intended for use in a push-pull circuit. The 10,000 ohms refers to the load impedance required by the output valves.

Knowing this, and knowing the impedance quoted for the loudspeaker, the manufacturer can work out the ratio of turns between the secondary and the primary to give him the power transfer he requires.

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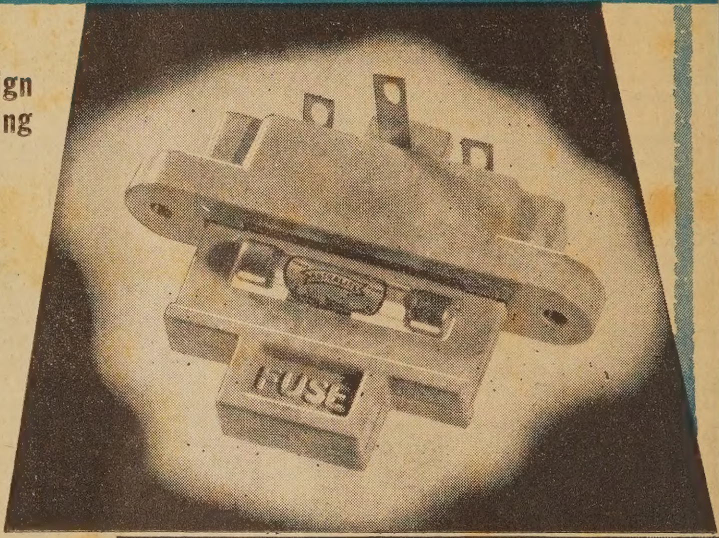
Fuse Holders



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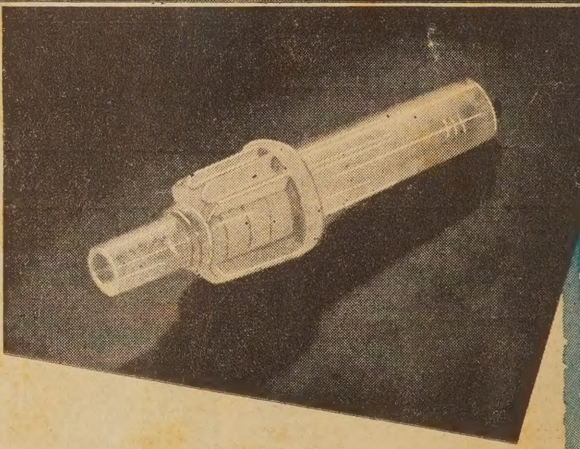
The M.S.P. mains fuse-holder Cat. No. 40845 is manufactured in *polystyrene* and primarily intended for mains fusing functions on TV, radio, amplifier chassis, etc. Captive drawer-slide accommodates standard 1¼" by ¼" metal-capped tubular glass fuse.

• •



The M.S.P. line or chassis-mounting fuse-holder Cat. No. 36546 is manufactured in *nylon* and offers advantages over other line fuse-holders by removal of fire hazard from short circuits prevalent with metal cased types. Also the flexibility of nylon enables this fuse-holder to be trodden-upon without damage or permanent distortion of shape. It is designed to accommodate any standard 1¼" by ¼" metal capped tubular glass fuse which is completely enclosed when inserted. This fuse-holder is particularly suitable for line fusing of electrical circuits in motor vehicles and for all similar applications. It is equally suitable for certain chassis mounting functions as for example in Television receivers as an EHT fuse-holder. However, it is not recommended for mains fusing applications as the method of changing fuses might involve contact being made accidentally with the power line.

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MSP2.5

ACTS ABOUT HOTOFLASH BULBS

(Continued from Page 49)

h the original, as indicated in the tch.

Another simple B-C power supply is wn in Fig. 9c. This employs the same nents as those in Fig. 9b, with some rrangement. The chief difference is t the capacitor is connected across battery at all times. Experiments e indicated that the stand-by current wn from a 22½-volt battery by typi- 100 microfarad capacitors ranges m 3 to 7 microamperes. If this cur- t is not exceeded, the service to be ected from the battery is essentially same as the battery's shelf life. In s circuit, as in Fig. 9b, additional nps should be conected in series with original.

TERCHANGEABLE

The B-C photoflash power supplies wn in Figs. 9b and 9c may be used h any type of expendable photoflash np in circuits where the energy stored the capacitor is used only to fire the np, or lamps. These power supplies therefore directly interchangeable h small dry cells in open flash work. d in the synchronised flash systems wn in Figs. 4, 6a and 6b. For reasons ntioned later, the simple B-C systems Figs. 9b and 9c are not directly ap- cable to photoflash synchronisers ich employ a solenoid to trip the tter.

Typical circuit component values for ng varying numbers of lamps for the stems sketched in Figs. 9b and 9c presented in Table 1.

If a charged capacitor will fire a otoflash lamp, it can be used to trip camera shutter, assuming that adequate ergy is stored in the capacitor. Both these applications involve a single dden burst of energy, and charged pacitors are ideal power sources for s mode of operation.

LENOID PROBLEM

Some development work done at ational Carbon Company's Research boratories in 1940 indicated that a arged capacitor could be used to trip mera shutters with solenoids, but the stem displayed one unfavourable char- teristic: it tripped the shutter too early.

The problem is presented in diagram shion in Fig. 10. Here a flash lamp d a shutter-tripping solenoid are con- cted in a symmetrical circuit. Both the energy storage capacitors, C1 and 2, derive their energy from a common ttery. The problem revolves around sing the solenoid switch, S2, a fixed ne after the lamp switch, S1, closes. compensate for the tendency of the utter to open early.

Experiment shows that the required ne differential is from 10 to 12 milli- conds to achieve good synchronisation shutter speeds of 1/200 or 1/400 sec- d. Repeatable time delays of the de- ed magnitude have been achieved ex- rimentally with the use of one-shot orators, relays and spring-loaded itches.

Once the correct delay is established, justment of the solenoid itself and ttery condition have little effect on the shutter timing. If the shutter trips, it is usually within the required time limits. Typical circuit component values for operating selenoids are listed in Table 2.

National Carbon Company's Research Laboratories have made many measurements relating to voltage, current, light and time for flashlamps and solenoids. By the process of integrating oscillograph records, the energy requirements for flashing lamps and tripping shutters have been examined, and approximate design data developed.

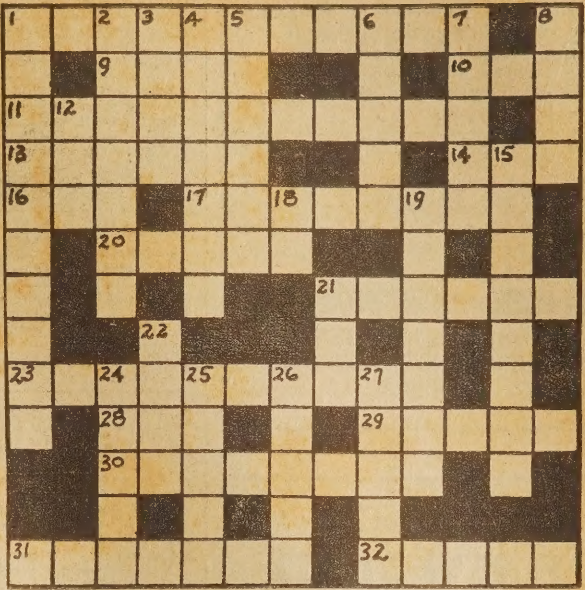
It has been fairly well established that a battery providing at least three volts for each lamp connected in series should be used with a capacitor of adequate energy storage. It has been further established that a capacitor storing at least .01 watt-seconds energy for each lamp in series should be used. Then using the relation:

$$W = \frac{CE^2}{2}$$

the required minimum capacitance and battery voltage to insure reliable operation may be determined. In the expression above, W is given in joules, or watt-seconds, when C is in farads and E is in volts. Table 1 shows battery voltage and capacitance values required to fire various numbers of lamps, using circuits similar to those of Figs. 9b and 9c.

Using similar reasoning, it has been experimentally determined and proven in practice that approximately 0.1 watt-seconds energy is required to trip the stiffest shutters with solenoids of popular designs. Table 2 shows battery voltage and capacitance values required to trip shutters, based on this premise. It should again be mentioned that some form of delay should be injected in the switching mechanism to accomplish good synchronisation.

THE R., TV & H. CROSSWORD No. 61



ACROSS

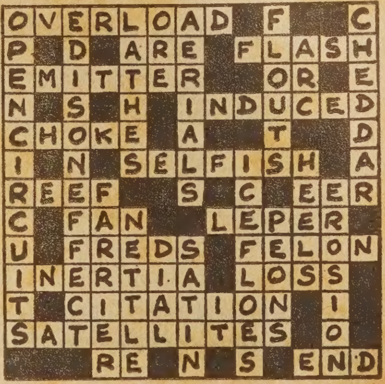
1. Semi-conductor devices.
9. Perceived.
10. Congealed water.
11. Diminution of electrical signal.
13. Closer.
14. Feline.
16. Perched.
17. Type of vacuum tube, brightly luminous with an electric discharge but broken up by dark spaces.
20. A decree of the Turkish Government.
21. An Indian hut.
23. Result of reflected sound wave (2 words).
28. To do wrong.
29. Perceives by the ear.
30. Another term for retroaction.
31. Vibrating reed giving off a note (pl.).
32. Highly volatile fluid.

DOWN

1. Another term for a loud-speaker.
2. Type of moving-magnet galvanometer.
3. Never (abbrev.).
4. Province in French-West Africa.
5. Exposed in use.
6. Leaves out.
7. Because.
8. Sensation of warmth.
12. Beverage.
15. Part of a generator.
18. That is (abbrev.).
19. To make less heavy.
21. Little.
22. Laminations of a transformer.
24. The unit of frequency.
25. To rub out.
26. Destinies determining events.
27. Filtering component.

Solution and further crossword next month

Last month's solution



O	V	E	R	L	O	A	D		F			C
P		D		A	R	E		F	L	A	S	H
E	M	I	T	T	E	R			O	R		E
N		S		H		I	N	D	U	C	E	D
C	H	O	K	E		A			T			D
I		N		S	E	L	F	I	S	H		A
R	E	E	F			S		C		E	E	R
C		F	A	N			L	E	P	E	R	
U		F	R	E	D	S		F	E	L	O	N
I	N	E	R	T	I	A		L	O	S	S	
T		C	I	T	A	T	I	O	N		I	
S	A	T	E	L	L	I	T	E	S		O	
			R	E		N		S		E	N	D

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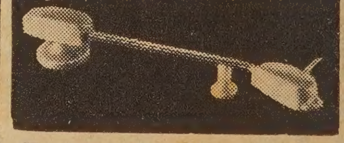

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